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1. Phase I Report  
& Work Plan

2. Appendixes A-F

**PHASE 1 REPORT AND WORK PLAN**  
**CHARACTERIZATION OF CAULK IN CONCRETE PAVEMENTS**  
**AT BOEING PLANT 2**

**Boeing Plant 2**  
**Seattle/Tukwila, Washington**

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**May 2008**

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*Final*

USEPA RCRA



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**ATTACHMENTS**

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Attachment B: Data Validation QA/QC Review

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**APPENDICES – ELECTRONIC COPIES ONLY, ON CD ATTACHED TO REPORT**

**A, Worksheets**

- Sample List
- Worksheet 1, 2-10 & 2-40 Sample Descriptions
- Worksheet 2, 2-60s Sample Descriptions
- Worksheet 3, Sample List, Caulk Type, PCB Concentration

**B, Field Sampling Sheets**

- 2-10 Area Field Sampling Sheets
- 2-40 Area Field Sampling Sheets
- 2-60s Area Field Sampling Sheets

**C, Field Maps**

- Sample Location Sketches
- Joint Mapping Sketches, 2-10 Area
- Joint Mapping Sketches, 2-40 Area

**D, Caulk Sampling Photos**

- 2-10 Caulk Sampling Photos
- 2-40 Caulk Sampling Photos
- 2-60s Caulk Sampling Photos

**E, 2007 Caulk Data Validation Checklists and Form 1s**

**F, 2-60s/2-66 Area Data Validation**

- October 2005 Samples Level 1 DV
- January 2006 Samples Level 1 DV
- April 2006 Samples Level 1 DV

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**List of Abbreviations/Acronyms**

<b>Abbreviation/Acronym</b>	<b>Definition</b>
Boeing	The Boeing Company
EPA	United States Environmental Protection Agency
Golder	Golder Associates, Inc.
IM	Interim Measure
IM Work Plan	Interim Measure Work Plan: Characterization of Caulk in Concrete Pavements at Boeing Plant 2
NPDES	National Pollutant Discharge Elimination System
PCB	polychlorinated biphenyl
ppm	parts per million
OA	Other Area
Order	Order on Consent
RCRA	Resource Conservation and Recovery Act
RL	reporting limit
SWMU	Solid Waste Management Unit



## **Phase 1 Report and Work Plan Characterization of Caulk in Concrete Pavements at Boeing Plant 2**

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### **1.0 INTRODUCTION**

The Boeing Company (Boeing) has collected caulk samples from concrete pavements in the 2-10, 2-40, and 2-60s/2-66 Areas of the Plant 2 facility in Seattle/Tukwila, Washington. The caulk samples were analyzed for polychlorinated biphenyls (PCBs) and existing data were reviewed in accordance with the Interim Measure (IM) Work Plan, Characterization of Caulk in Concrete Pavements at Boeing Plant 2, dated August 2007. The IM Work Plan was prepared, and the subject portion of the IM performed, in accordance with Administrative Order on Consent (Order) No. 1092-01-22-3008(h) between Boeing and the Environmental Protection Agency (EPA) Region X. The Order is issued pursuant to Section 3008(h) of the Solid Waste Disposal Act, also referred to as the Resource Conservation and Recovery Act (RCRA). The Work Plan was submitted pursuant to EPA's February 15, 2007 and April 11, 2007 letters, the latter being sent following Boeing's February 26, 2007 letter, and discussions on this subject. In short, the EPA letters required Boeing to submit an interim measure work plan to identify all polychlorinated biphenyl (PCB) contaminated caulk at the facility with concentrations of PCBs above 1 part per million (ppm). The April 2007 letter specified inclusion of a discussion on the removal of all caulk with PCB concentrations in excess of 50 ppm and the stabilization of all caulk with PCB concentrations between 25 and 50 ppm. Potential methods of removal and stabilization were discussed in the IM Work Plan, and will be further addressed in the next phase of this IM.

In accordance with the IM Work Plan, this Phase 1 Report describes the caulk sampling, analysis, and review of existing data that have been conducted during 2007 to characterize the joint caulk in the outdoor concrete pavements of Plant 2.

### **1.1 Background**

Plant 2 is located on 109 acres between the Duwamish Waterway and East Marginal Way South in Seattle and Tukwila, Washington (Figure 1). With the exception of small landscaped areas, the ground surface at Plant 2 is either paved or covered by buildings. Stormwater falling upon pavement or buildings is discharged to the Duwamish Waterway under a National Pollutant Discharge Elimination System (NPDES) and State Waste Discharge General Permit for Stormwater Discharges Associated with Industrial Activities, in compliance with the State of Washington Water Pollution Control Law (Chapter 90.48 RCW) and the Federal Water Pollution Control Act (The Clean Water Act) (Title 33 United States Code, Section 1251 et seq.).

### **1.2 Description of Plant 2 Pavements and Slabs**

The outdoor pavements at Plant 2 were divided into five geographical areas for the purpose of this IM Work Plan (Figure 2). The five geographical areas include the South Yard, the 2-60s/2-66 Area, the 2-40 Area, the 2-10 Area and the North Area. The outdoor surfacing in the South Yard comprises an area of approximately ten acres, and consists primarily of recent asphalt with little or no caulk material. A small area near the SCL Transformer pad is concrete that will be replaced with asphalt when that space is remediated. The outdoor surfacing in the 2-60s/2-66, 2-40, and 2-10 Areas comprise a combined area of approximately 27 acres, and consists primarily of older, jointed and/or cracked concrete with caulk material in the joints and/or cracks. Caulk materials from the concrete pavements and building slabs in the 2-60s/2-66 Area were sampled during 2005 and 2006, and those data are discussed and applied in this report. The outdoor surfacing in the North Area comprises an area of



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approximately 13 acres, and consists primarily of recent asphalt with little or no caulk material. Figure 2 includes estimates of the pavement areas and joint lengths for each area at Plant 2. On the east side of the 2-20s series of buildings, some small paved spaces are comprised of concrete and joint materials that were constructed in the 1990s; these small spaces were not, therefore, included in this work plan. On the east margin of the 2-10 Area, the below-grade parking (purchased recently from BOC Gases) is asphalt paved, while the caulk has already been removed from within the jet fuel tank bermed area.

Accordingly, and as is described further below, the concrete pavements and slabs in the 2-60s/2-66 Area and the outdoor concrete pavements in the 2-10 Area and the 2-40 Area are the focus of this IM Work Plan due to the presence, age and nature of the caulk materials in concrete in those areas.

### **1.3 Recent Actions**

#### **1.3.1 2-60s/2-66 Area Caulk Investigation**

Between October 2005 and April 2006, following identification of PCBs in catch basin solids samples collected in stormlines X and Y, Boeing investigated caulking materials that had been applied to joints in paved roadways and concrete slabs in the drainage area served by Lines X and Y (2-60s/2-66 Area). The investigation was conducted to provide an indication of whether joint caulk materials may have been a possible source of PCBs. Inspection of these areas revealed multiple applications of a variety of caulk materials used to seal cracks and seams in the roadways and building slabs. Sample locations were selected based on their variability of joint materials and the relative amount of joint material present. Forty-six caulk samples, representative of the numerous types of caulk material (based on appearance) observed in the area, were collected during this investigation. The physical characteristics of the joint materials were recorded for each sample location, and the samples were sent to an analytical laboratory for testing. Results for PCBs ranged from non-detect (at a reporting limit [RL] of 0.79 ppm) to 40,500 ppm. A summary of the results of this investigation was presented as Table 1 in Attachment A of the IM Work Plan (August 2007). The PCB concentrations in caulk used in the 2-60 series concrete pavement areas were significantly lower than concentrations in the caulk used in the 2-60 series building concrete slabs. Additional review, sampling, analysis and evaluation of these data and related field sampling sheets were performed for characterization purposes as part of this present IM Work Plan and are included in this Phase 1 Report.

#### **1.3.2 Construction and Removal Activities**

In March 2006, installation of a temporary stormwater collection and treatment system was completed to replace the drainage capacity of stormlines X and Y. This construction activity resulted in the temporary sealing at the surface of all the catch basins and manholes on the X and Y lines to remove those lines from service, and the installation of new drains, lines, asphalt swales and a modern treatment vault which collects solids and stormwater and conveys stormwater into stormline Z. Line Z is immediately south of the X and Y lines. In October 2006 following a video survey, the catch basins and manholes on the X and Y lines in the 2-66 Area were backfilled with controlled density fill (CDF) and the accessible outfalls for those lines were sealed at the waterway. In May 2007, Boeing completed the removal of the X and Y lines from the 2-60s area (east of the 2-66 Area), as documented in the Draft Interim Measure Completion Report, Removal of Stormwater Lines X & Y (OA 23.1 and OA 23.2) in 2-60s Area at Boeing



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Plant 2, dated July 2007. Additionally, Building 2-64 was demolished in May 2007 and its foundations and immediately adjacent pavements were removed and replaced with asphalt surfacing.

As a result of the removal of the X and Y stormlines and the demolition of Building 2-64, caulks at the locations of five of the samples collected in the 2-60s Area during 2005/2006 were removed. These five caulk samples had PCB concentrations ranging from non-detect (at an RL of 0.8 ppm) to 740 ppm. Additionally, all caulk represented by three samples containing PCB concentrations ranging from 29,300 ppm to 40,500 ppm were removed by Boeing from an equipment foundation on the Building 2-65 slab (see Figure 6).

#### **1.3.3 Stormwater Sampling**

To further investigate concentrations of PCBs and metals detected in storm solids during a survey of the Plant 2 stormwater system during 2005, EPA required Boeing to initiate an annual stormwater source control sampling program to evaluate the potential for active stormwater lines at Plant 2 to convey hazardous substances to the Duwamish Waterway via stormwater discharges. To address EPA's requirements identified in a May 26, 2006 letter, the Stormwater Source Control Work Plan for Boeing Plant 2 (Golder, 2006) was initiated in October, 2006. The work plan established a source control sampling program consisting of one-time or annual sampling and analysis of suspended solids and/or water along 12 of the 24 active stormwater lines at Plant 2 during the rainy season (approximately October to March). Source control sampling results are compared to action levels established in the work plan, and action level exceedence triggers further source control action(s).

The first round ("round 1") of source control sampling was conducted between October 18, 2006 and April 19, 2007, and the round 1 sampling report (Golder, 2007b) was approved by EPA in October, 2007. Round 2 sampling commenced in October 2007, and is currently ongoing according to the Revised Stormwater Source Control Work Plan for Boeing Plant 2 (Golder, 2007c). Annual source control sampling will continue until baseline conditions have been established, and the appropriate source control actions have been identified, completed, and verified.

Given the possible association between the caulk at Plant 2 and the PCB concentrations detected in the stormwater system solids, the above information regarding source control sampling is pertinent and has therefore been included in this Phase 1 Report and Work Plan.



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**2.0 OBJECTIVE OF INTERIM MEASURE**

The objective of this IM Work Plan is to first develop a baseline characterization of caulk materials in the outdoor concrete pavements at Plant 2. The baseline characterization is presented in this Phase 1 Report, and includes correlation of caulk physical properties (i.e., appearance and texture) to PCB concentrations in the caulk. This characterization establishes the visual properties that will be used to distinguish among all caulks containing varying levels of PCB concentrations from caulks containing PCB concentrations less than or equal to 1 ppm. The baseline characterization, when approved, will be used to determine and map locations subject to required actions for caulk materials containing concentrations of PCBs above 25 ppm in the concrete pavements throughout Plant 2. That result and the specific recommended actions will be presented in the next report on this Interim Measure.

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### Characterization of Caulk in Concrete Pavements at Boeing Plant 2

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#### 3.0 CAULK CHARACTERIZATION

The IM Work Plan (August 2007) focused on the three areas of Plant 2 in which caulk has been used in the joints and/or cracks in concrete pavements: the 2-60s/2-66 Area, the 2-40s Area and the 2-10 Area. The surfaces in the South and North Areas are of asphalt installed during redevelopments over the last fifteen years or so. The age of the asphalt, and the general absence of joints or seams and the caulk material that would fill them, eliminated those other areas from detailed consideration in this IM Work Plan.

A review of historical photographs indicated that the three subject areas were not constructed at the same time. The 2-40s Area was constructed approximately during 1940/1941, the 2-60s/2-66 Area was constructed approximately during 1942, and the 2-10 Area was constructed approximately during 1953. Despite the different periods of construction, it is unknown whether the same caulk materials were used in each area during construction. However, it is likely that the caulk materials subsequently used for maintenance purposes in the following decades were the same or similar throughout each of these areas. As such, we hypothesized that while the original caulks used for construction may vary from area to area, the maintenance caulks are likely common between each of the areas. In general, the caulk analytical and characterization results presented herein indicate that most caulk types at Plant 2 have similar PCB concentration ranges across the site, but a few of the caulks have variable concentrations between the areas investigated.

A systematic approach was implemented to develop a baseline characterization of the caulk types in the three subject areas.

- Pre-existing 2005/2006 caulk data from the 2-60s/2-66 Area were first reviewed and evaluated to determine the physical appearances that may be used to identify those same caulks that may be present elsewhere in the study area. Duplicate samples were collected during 2007 as part of this IM at the same locations as the 2005/2006 samples to enable closer visual examination of the caulks and standardization of caulk descriptions. Additionally, several duplicate samples were submitted for laboratory analyses in cases where the 2005/2006 analytical data indicated PCB reporting limits (RLs) above 1 ppm that would compromise the use of those earlier results.
- Caulk sampling and analytical testing was conducted on caulks in the 2-10 and 2-40 Areas. Data for all three subject areas were reviewed and evaluated with the objective of establishing the visual properties for each distinct caulk type that could in turn be used to identify all caulks containing respective concentrations of PCBs.
- Caulk types were initially evaluated and characterized on the basis of visual properties first separately by area (attached Table 1), and then collectively for all three areas (attached Table 2).

Careful review of the data and close examination of archived caulk material samples resulted in the identification of fifteen types of caulk materials in the outdoor pavements of the 2-60s/2-66, 2-10, and 2-40 Areas. Several of the caulk types were observed in all three areas, but not all of the caulk types were observed in all three areas. Based on the physical characteristics of the caulk materials, irrespective of PCB concentrations, the caulk types were categorized as shown below:



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Caulk Type	Color	Description	Area (s) Located*
1A	Dull black	Stiff to hard. Fresh surface black, glassy, rough, crumbly.	2-10, 2-40, 2-60
1B	Dull black	Stiff to hard, brittle. Fresh surface black, glassy, conchoidal fracture.	2-10, 2-40, 2-60
1C	Dull black	Same as Type 1A, but includes metal shavings, small screws, etc. in caulk matrix.	2-10, 2-40
1D	Dull black	Same as Type 1A, but pliable to semi-pliable.	2-40
1E	Dull black	Soft to stiff, pliable to semi-pliable. Fresh cut surface dull to semi-glossy black, smooth to rough.	2-10, 2-40, 2-60
2A	Light gray	Soft to stiff, pliable, spongy to rubbery.	2-10, 2-40, 2-60
2B	Light gray	Strong, very stiff to very hard, brittle.	2-10
2C	Dull gray	Stiff to hard, pliable.	2-40, 2-60
3	Brown to black	Soft to firm, pliable & spongy.	2-10, 2-60
4	Dull brown or black	Soft, fibrous, friable.	2-60
5	Brown	Soft, pliable, spongy, stretchy, sticky.	2-60
6	Reddish-brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange.	2-60
7	Amber	Smooth, translucent, very hard, glassy.	2-10
8A	White	Soft to stiff, pliable, spongy.	2-60
8B	White	Firm to stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white.	2-60

\*2-60 refers to 2-60s/2-66 Area

Extent of caulk material exposure to sun or vehicular traffic was not a determinative factor in this characterization process.

### 3.1 2-60s/2-66 Area Caulk Investigation

Boeing conducted an investigation of the caulk in concrete pavements and slabs in the 2-60s/2-66 Area between October 2005 and April 2006. Forty-six caulk samples were collected during that investigation to provide an indication of whether the caulk could potentially have been a source of the PCBs detected in the stormwater system in that part of Plant 2. Samples were collected based upon physical appearance, with the greatest number of samples representing the most predominant caulk types observed in the area. The original sample descriptions included such physical properties as color and texture. Analytical results for the samples indicated PCB concentrations ranged from non-detect (at an RL of 0.79 ppm) to 40,500 ppm, with the higher values being consistently associated with building slab caulk applications, as opposed to road or parking lot caulk applications. The original caulk



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descriptions and PCB concentrations were presented in Table 1 of Attachment A in the IM Work Plan (August 2007).

#### 3.1.1 2-60s/2-66 Area Investigation during 2007

The 2007 investigation of caulk materials in the 2-60s/2-66 Area included the primary tasks described below.

- **Data review:** The 2005/2006 descriptions of the caulk materials and the PCB concentrations of all the samples were reviewed and evaluated for characterization standardization purposes.
- **New archive samples:** To enable a closer and systematic examination of the caulk materials and standardized descriptions of the 46 caulk samples from the 2-60s/2-66 Area, archive samples were collected during 2007 at the same locations as the original 2005/2006 samples, with the exception of the eight sample locations where the caulk materials had been removed. The exact locations of the new archive samples were determined by the 2005/2006 sample location map descriptions and markings on the pavement.
- **Sample descriptions and categories:** Archived samples were visually examined and descriptions were recorded on field sampling sheets. The archived samples were then re-examined and caulk types were assigned to the samples based upon the physical characteristics of the caulk materials. The 2005/2006 caulk descriptions were used to categorize the eight caulk samples that had been previously removed.
- **Duplicate samples for laboratory analyses:** Four samples were collected in 2007 and submitted for laboratory analyses. The collected samples were intended as duplicates of specific 2005/2006 samples that had non-detected PCB concentrations at RLs greater than 1 ppm. The 2005/2006 elevated RLs were due to chromatographic interferences during the analyses. An additional cleaning step was applied during the preparation of the 2007 samples to reduce chromatographic interference, and the samples were then analyzed achieving a lower RL than reported for those samples in the data suite from 2005/2006.

#### 3.1.2 2-60s/2-66 Area Caulk Types & PCB Concentrations

As a result of this investigation, eleven caulk types were identified in the 2-60s/2-66 Area. The caulk types and PCB concentrations of those materials are discussed below, presented in attached Tables 1 & 2, and shown on Figure 6. Tables 1 and 2 also include comments regarding the general condition of the caulks at the locations sampled.

- **Type 1A:** Based upon visual properties, seventeen samples including two duplicates were categorized as Type 1A caulk in the 2-60s/2-66 Area. Six of the samples were generally located between the 2-63 slab and the waterway, ten of the samples were located on the 2-62 slab, and one sample was located at the southwest corner of Building 2-64. The six samples located between the 2-63 slab and the waterway contained PCB concentrations that ranged from non-detect (at an RL of 0.79 ppm) to 13.0 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 14.5 ppm determined for the fifteen other Type 1A samples collected in the 2-10 and 2-40 Areas.



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The ten Type 1A samples located on the 2-62 slab, including two duplicates, had PCB concentrations that ranged from 1.7 ppm to 39,000 ppm. Five of these ten samples had PCB concentrations that ranged from 1.7 to 10.3 ppm, consistent with the PCB concentrations determined in Type 1A caulk elsewhere at Plant 2. However, the other five samples contained higher PCB concentrations that ranged from 45.8 to 39,000 ppm, much higher than any other Type 1A PCB concentrations determined sitewide. The higher concentrations of PCBs in these five caulk samples from the 2-62 slab are likely anomalous relative to the caulk itself and may be related to historical industrial uses of the 2-62 building areas from which the samples were collected. As a result of the high concentrations of PCBs in these five samples, all Type 1A caulk on the 2-62 slab will be conservatively suspected of containing elevated concentrations of PCBs and recommended remedies for these materials will be addressed accordingly in the final report of this IM.

The Type 1A sample collected at the southwest corner of Building 2-64 had a PCB concentration of 740 ppm. Two other samples of the same type caulk were collected within 6 feet and 11 feet of the 740 ppm sample, and these two samples contained PCB concentrations ranging from non-detect (at an RL of 0.8 ppm) to 1.8 ppm. The 740 ppm PCB concentration appears to have been an anomaly for that caulk type, and may be related to past equipment and operations in that area, including historically removed transformers and a RCRA unit, SWMU 77.B, PCB Retention Tank (Figure 6). The caulk represented by all three of these samples, along with the surrounding concrete, was removed and replaced with asphalt when Building 2-64 was demolished in 2007.

As a result of the ranges of PCB concentrations detected in Type 1A caulk and described above, two subsets of this caulk type were further delineated based upon PCB concentrations of less than 25 ppm or greater than 50 ppm as follows:

- **Type 1A1 ( $\leq 25$  ppm PCBs).** Eleven of the above Type 1A caulk samples had PCB concentrations that ranged from non-detect to 13.0 ppm. Specifically included in this subset were the six samples (generally located between the 2-63 slab and the waterway) that had PCB concentrations that ranged from non-detect to 13.0 ppm, and the 5 samples (located on the 2-62 slab) that had PCB concentrations that ranged from 1.7 to 10.3 ppm.
- **Type 1A2 ( $> 50$  ppm PCBs).** Six of the above Type 1A caulk samples had PCB concentrations that ranged from 45.8 to 39,000 ppm. Specifically included in this subset were the five samples (located on the 2-62 slab) that had PCB concentrations that ranged from 45.8 to 39,000 ppm, and the one sample (located near the southwest corner of Building 2-64) that had a PCB concentration of 740 ppm.
- **Type 1B:** Four samples were categorized as Type 1B caulk in the 2-60s/2-66 Area. PCB concentrations in the four samples ranged from 2.5 to 8.1 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 7.2 ppm determined for the fourteen other Type 1B samples collected in the 2-10 and 2-40 Areas.
- **Type 1E:** Three samples including one duplicate were categorized as Type 1E caulk in the 2-60s/2-66 Area. PCB concentrations in the three samples ranged from non-detect (at an RL of 0.79 ppm) to 1.4 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 3.0 ppm determined for the nineteen other Type 1E samples collected in the 2-10 and 2-40 Areas.



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- **Type 2A:** Three samples were categorized as Type 2A caulk in the 2-60s/2-66 Area. PCB concentrations in the three samples were non-detect at an RL of 0.8 ppm. These non-detected concentrations are consistent with the non-detected PCB concentrations at RLs ranging from 0.79 to 2.0 ppm for the six other Type 2A samples collected in the 2-10 and 2-40 Areas.
- **Type 2C:** Two samples located on the 2-65 slab in the 2-60s/2-66 Area were categorized as Type 2C caulk based upon the 2005/2006 descriptions of those samples. PCB concentrations in the two samples were 29,300 ppm and 40,500 ppm. These concentrations are not consistent with the non-detected PCB concentration (at an RL of 0.79 ppm) in the only other Type 2C caulk sample that was identified during this investigation in the 2-40 Area. The high concentrations of PCBs in the caulk samples from the 2-65 slab may be related to historical uses of the equipment foundation from which the samples were collected. Boeing removed all of the Type 2C caulk material from the equipment foundation on the 2-65 slab. No other Type 2C caulk was observed in the 2-60s/2-66 Area during this investigation.
- **Type 3:** Two samples were categorized as Type 3 caulk in the 2-60s/2-66 Area. PCB concentrations in the two samples were non-detect (at an RL of 0.8 ppm) and 2.2 ppm. This range of concentrations is consistent with the non-detected PCB concentrations at RLs of up to 0.8 ppm for the other two Type 3 samples collected in the 2-10 Area.
- **Type 4:** Six samples were categorized as Type 4 caulk in the 2-60s/2-66 Area. Five of these samples had PCB concentrations that ranged from 5.2 to 27.0 ppm and one sample had a PCB concentration of 34,000 ppm. No other Type 4 caulk materials were found in the 2-10 or 2-40 Areas during this investigation. Some of the caulk containing the lower range of PCB concentrations was removed from the west side of Building 2-64 as a result of the demolition of that building. Caulk represented by the sample containing 34,000 ppm PCBs was located on and removed by Boeing from the equipment footing on the 2-65 slab where Type 2C caulk (above) was also removed. The high concentrations of PCBs in the Type 4 and Type 2C caulk samples collected at the equipment footing on the 2-65 slab may be related to historical uses of the area from which the samples were collected.
- **Type 5:** Five samples, three of which were duplicates of the first two samples, were categorized as Type 5 caulk in the 2-60s/2-66 Area. The first two samples and one of the duplicates, all collected during 2005/2006, had non-detected concentrations of PCBs at RLs ranging from 16 ppm to 80 ppm. The RLs of these samples were elevated due to chromatographic interference during the analyses of the samples. For this reason, two additional samples, intended as duplicates, were collected for re-analyses during 2007 from the same locations as the 2005/2006 samples. An additional cleaning step was added to the sample preparation of the two new duplicates to reduce the chromatographic interference during the analyses of the samples. The final results of the analyses of the duplicate samples indicated non-detected concentrations of PCBs at RLs of 9.6 ppm and 9.9 ppm. These RLs supersede the originally reported RLs, and the RLs for non-detected concentrations of PCBs in Type 5 caulk have been revised to the range of 9.6 to 9.9 ppm. No other Type 5 caulk materials were found in the 2-10 or 2-40 Areas during this investigation.
- **Type 6:** Three samples were categorized as Type 6 caulk in the 2-60s/2-66 Area. PCB concentrations in the samples ranged from 6.2 to 10.0 ppm. No other Type 6 caulk materials were found in the 2-10 or 2-40 Areas during this investigation.



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- **Type 8A:** Three samples including two duplicates of the first sample were categorized as Type 8A caulk in the 2-60s/2-66 Area. The original sample and a duplicate collected in 2005/2006 had non-detected PCB concentrations at RLs of 400 ppm and 560 ppm. The RLs of these samples were elevated due to chromatographic interference during the analyses of the samples. For this reason, an additional sample, intended as a duplicate, was collected for re-analyses during 2007 from the same location as the 2005/2006 samples. An additional cleaning step was added to the sample preparation of the new duplicate to reduce the chromatographic interference during the analysis of the sample. The final result of the analysis of the new duplicate sample indicated a non-detected concentration of PCBs at an RL of 7.8 ppm. This RL supersedes the originally reported RLs, and the RL for non-detected concentrations of PCBs in Type 8A caulk has been revised to 7.8 ppm. No other Type 8A caulk materials were found in the 2-10 or 2-40 Areas during this investigation.
- **Type 8B:** Two samples were categorized as Type 8B caulk in the 2-60s/2-66 Area. PCB concentrations in the samples were 1.6 ppm and 2.7 ppm. No other Type 8B caulk materials were found in the 2-10 or 2-40 Areas during this investigation.

### 3.2 2-10 Area Caulk Investigation

#### 3.2.1 Sampling

A grid system of north-south and east-west trending lines was established on maps of the 2-10 Area for the purpose of randomly selecting locations for sampling and characterizing the caulk in the concrete pavements. The grid lines generally had a spacing of 75-feet forming a series of 75-foot square blocks, however, due to pavement configurations some of the blocks had irregular shapes. A total of 83 sampling blocks were prescribed, and each block was assigned a unique identification number. Using a random number generating program, AbleBits™, Version 1.2.0.14, ten of the blocks were randomly selected for caulk sampling and characterization (Figure 3).

In each of the ten selected blocks, all of the caulk types present were physically characterized based on color and texture of both weathered and fresh surfaces. Samples were collected of each caulk type observed in each of the blocks, the physical characteristics of the samples were recorded on field sampling sheets, and the samples were submitted for PCB analysis. Archive samples were also collected to enable follow-up examination of the caulk materials and further standardization of the descriptions. This process provided representative samples for the physical and chemical (PCB) characterization of the caulk types observed in the 2-10 Area.

#### 3.2.2 2-10 Area Caulk Types and PCB Concentrations

As a result of this investigation, a total of 33 samples were collected and eight caulk types were identified in the 2-10 Area. The caulk types and PCB concentrations of those materials are discussed below, presented in attached Tables 1 & 2, and shown on Figure 4. Tables 1 and 2 also include comments regarding the general condition of the caulks at the locations sampled.

- **Type 1A:** Based upon visual properties, ten samples including two duplicates were categorized as Type 1A caulk in the 2-10 Area. In accordance with the Type 1A caulk subsets that were further delineated based upon PCB concentrations and described above in Section 3.1.2, all ten samples collected in the 2-10 Area were designated as Type 1A1 caulk (containing  $\leq 25$  ppm PCBs). PCB concentrations in the ten samples ranged from non-detect (at an RL of 0.79 ppm) to 14.5 ppm. This range of



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concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 13.0 ppm determined for the sixteen other Type 1A1 samples from the 2-40 and 2-60s/2-66 Areas.

- **Type 1B:** Eight samples including one duplicate were categorized as Type 1B caulk in the 2-10 Area. PCB concentrations in the eight samples ranged from non-detect (at an RL of 0.79 ppm) to 7.2 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 8.1 ppm determined for the ten other Type 1B samples collected in the 2-40 and 2-60s/2-66 Areas.
- **Type 1C:** Based upon visual properties, three samples were categorized as Type 1C caulk in the 2-10 Area. PCB concentrations in the samples ranged from 29.0 to 40.0 ppm. This range of concentrations is higher than the PCB concentration range of 7.8 to 12.3 ppm determined for three other Type 1C samples collected in the 2-40 Area. The three samples from the 2-10 Area were located to the south and southwest of Building 2-10.

As a result of the ranges of PCB concentrations detected in the Type 1C caulk samples described above, two subsets of this caulk type were further delineated based upon PCB concentrations of less than 25 ppm or 25 to 50 ppm as follows:

- **Type 1C1 ( $\leq 25$  ppm PCBs).** The three Type 1C samples collected in the 2-40 Area had PCB concentrations of less than 25 ppm. The samples are discussed in Section 3.3.2 with other 2-40 Area data.
- **Type 1C2 ( $>25$  ppm and  $\leq 50$  ppm PCBs).** The three Type 1C samples collected in the 2-10 Area had PCB concentrations that ranged from 29.0 to 40.0 ppm.
- **Type 1E:** Four samples were categorized as Type 1E caulk in the 2-10 Area. PCB concentrations in the four samples ranged from non-detect (at an RL of 0.79 ppm) to 2.5 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 3.0 ppm determined for the eighteen other Type 1E samples collected in the 2-40 and 2-60s/2-66 Areas.
- **Type 2A:** Three samples including one duplicate were categorized as Type 2A caulk in the 2-10 Area. PCB concentrations in the three samples were non-detect at RLs ranging from 0.8 to 2.0 ppm. These non-detected concentrations are consistent with the non-detected PCB concentrations at RLs ranging from 0.79 to 1.6 ppm in the six other Type 2A samples collected in the 2-40 and 2-60s/2-66 Areas.
- **Type 2B:** One sample was categorized as Type 2B caulk in the 2-10 Area. PCBs were not detected at an RL of 0.8 ppm. No other Type 2B caulk was found in the 2-40 or 2-60s/2-66 Areas during this investigation.
- **Type 3:** Two samples were categorized as Type 3 caulk in the 2-10 Area. PCBs were not detected in the two samples at RLs of up to 0.8 ppm. These non-detected PCB concentrations are generally consistent with the non-detected PCB concentrations at RLs of 0.8 ppm and 2.2 ppm for the other two Type 3 samples collected in the 2-60s/2-66 Area.
- **Type 7:** Two samples were categorized as Type 7 caulk in the 2-10 Area. PCB concentrations in the two samples were non-detect (at an RL of 0.79 ppm) and 3.2 ppm. No other Type 7 caulk was identified in the 2-40 or 2-60s/2-66 Areas during this investigation.



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#### 3.3 2-40 Area Caulk Investigation

##### 3.3.1 Sampling

A grid system of north-south and east-west trending lines was established on maps of the 2-40 Area for the purpose of randomly selecting locations for sampling and characterizing the caulk in the concrete pavements. The grid lines generally had a spacing of 75-feet forming a series of 75-foot square blocks, however, due to pavement configurations some of the blocks had irregular shapes. A total of 30 sampling blocks were prescribed, and each block was assigned a unique identification number. Using a random number generating program, AbleBits™, Version 1.2.0.14, ten of the blocks were randomly selected for caulk sampling and characterization (Figure 3).

In each of the ten selected blocks, all of the caulk types present were physically characterized based on color and texture of both weathered and fresh surfaces. Samples were collected of each caulk type observed in each of the blocks, the physical characteristics of the samples were recorded on field sampling sheets, and the samples were submitted for PCB analysis. Archive samples were also collected to enable follow-up examination of the caulk materials and further standardization of the descriptions. This process provided representative samples for the physical and chemical (PCB) characterization of the caulk types observed in the 2-40 Area.

##### 3.3.2 2-40 Area Caulk Types and PCB Concentrations

As a result of this investigation, a total of 34 samples were collected and seven caulk types were identified in the 2-40 Area. The caulk types and PCB concentrations of those materials are discussed below, presented in attached Tables 1 & 2, and shown on Figure 5. Tables 1 and 2 also include comments regarding the general condition of the caulks at the locations sampled.

- **Type 1A:** Based upon visual properties, five samples were categorized as Type 1A caulk in the 2-40 Area. In accordance with the Type 1A caulk subsets that were further delineated based upon PCB concentrations and described above in Section 3.1.2, all five samples collected in the 2-10 Area were designated as Type 1A1 caulk (containing  $\leq 25$  ppm PCBs). PCB concentrations in the five samples ranged from non-detect (at an RL of 0.79 ppm) to 10.3 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 14.5 ppm determined for twenty-one other Type 1A1 samples from the 2-10 and 2-60s/2-66 Areas.
- **Type 1B:** Six samples were categorized as Type 1B caulk in the 2-40 Area. PCB concentrations in the six samples ranged from non-detect (at an RL of 0.79 ppm) to 5.0 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 8.1 ppm determined for the twelve other Type 1B samples collected in the 2-10 and 2-60s/2-66 Areas.
- **Type 1C:** Based upon visual properties, three samples were categorized as Type 1C caulk in the 2-40 Area. In accordance with the Type 1C caulk subsets that were further delineated based upon PCB concentrations and described above in Section 3.2.2, all three samples collected in the 2-40 Area were designated as Type 1C1 caulk (containing  $\leq 25$  ppm PCBs). PCB concentrations in the samples ranged from 7.8 to 12.3 ppm. This range of concentrations is lower than the PCB concentration range of 29.0 to 40.0 ppm determined for the three Type 1C2 samples collected from the 2-10 Area and discussed in Section 3.2.2.



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- **Type 1D:** Only one sample was categorized as Type 1D caulk in the 2-40 Area, and no other Type 1D caulk was found in the 2-10 or 2-60s/2-66 Areas during this investigation. The PCB concentration in the sample was 8.3 ppm.
- **Type 1E:** Fifteen samples were categorized as Type 1E caulk in the 2-40 Area. PCB concentrations in the fifteen samples ranged from non-detect (at an RL of 0.79 ppm) to 3.0 ppm. This range of concentrations is consistent with the PCB concentration range of non-detect (at an RL of 0.79 ppm) to 2.5 ppm determined for the seven other Type 1E samples collected in the 2-10 and 2-60s/2-66 Areas.
- **Type 2A:** Three samples including one duplicate were categorized as Type 2A caulk in the 2-40 Area. PCB concentrations in the three samples were non-detect at RLs ranging from 0.79 to 1.6 ppm. These non-detected concentrations are consistent with the non-detected PCB concentrations at RLs ranging from 0.8 to 2.0 ppm for the six other Type 2A samples collected in the 2-10 and 2-60s/2-66 Areas.
- **Type 2C:** One sample was categorized as Type 2C caulk in the 2-40 Area. PCBs were not detected in the sample at an RL of 0.79 ppm. The non-detected concentration in this sample is not consistent with the PCB concentrations of 29,300 ppm and 40,500 ppm in the only other two Type 2C caulk samples collected during this investigation in the 2-60s/2-66 Area, and categorized as Type 2C caulk based upon 2005/2006 descriptions. The high concentrations of PCBs in the caulk samples from the 2-60s/2-66 area may be related to historical uses of the equipment footing from which the two samples were collected on the 2-65 slab, as discussed in Section 3.1.2 of this report. Boeing removed all of the Type 2C caulk material from the equipment foundation on the 2-65 slab. Other than the 2-40 Area sample which contained no detected PCBs, no other Type 2C caulk was identified at Plant 2 during this investigation.

### 3.4 Site-wide Caulk Characterization Summary

The objective of the baseline characterization of the caulk materials in the outdoor concrete pavements and slabs of Plant 2 was to establish the visual properties that can be reliably used to distinguish among caulks with varying levels of elevated PCB concentrations from those caulks with PCB concentrations less than or equal to 1 ppm. More specifically, the characterization investigation was designed to establish the visual properties that can be used to distinguish between caulk materials containing the following PCB concentration categories:

- Caulks with PCB concentrations  $\leq 1$  ppm;
- Caulks with PCB concentrations  $> 1$  ppm and  $\leq 25$  ppm;
- Caulks with PCB concentrations  $> 25$  ppm and  $\leq 50$  ppm; and
- Caulks with PCB concentrations  $> 50$  ppm.

This baseline characterization comprised Phase 1 of the IM Work Plan and resulted in the identification of fifteen types of caulk materials in the 2-60s/2-66, 2-10 and 2-40 Areas, as detailed previously in this report. Visual indicators proved to be a reliable and fairly consistent means of distinguishing between different caulk products, with the exception of caulk types 1A and 1C. PCBs detected in several of the caulk types included concentrations that spanned two or more of the PCB concentration categories shown above. While most caulk types contained PCB concentration ranges that were fairly consistent in all three subject areas and most PCB concentrations were less than 25 ppm, several caulk samples contained elevated PCB concentrations that appear anomalous relative to the rest of the data set. The anomalous



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PCB concentrations in such samples lead to the proposed conclusion that the highly elevated PCB concentrations may be related to area, building and/or historical material uses at the locations of the subject samples. These elevated PCB concentrations warranted the development of subsets to the caulk types that otherwise contained lower and/or consistent PCB concentrations across the remainder of the site so as to not improperly skew the type data set.

Upon approval of this Phase 1 Report, Phase 2 of this IM Work Plan will include the mapping of the caulk types containing PCB concentrations greater than 1 ppm in the 2-10, 2-40, and 2-60s/2-66 Areas. Each type of caulk or subset of the caulk type will be designated as potentially containing PCB concentrations in one of the categories indicated above per the following protocol:

- Caulk types with consistent ranges of PCB concentrations that conform to one of the concentration categories indicated above will be mapped accordingly.
- Caulk types with consistent ranges of PCB concentrations that span two or more PCB concentration categories will be conservatively assumed to contain PCB concentrations in the category of the highest detected PCB concentrations unless the geographic distribution between areas provides a basis for making a distinction within a type.
- Caulk types with mostly consistent ranges of PCB concentrations, but including samples with anomalous, elevated PCB concentrations, have been divided into subsets of their respective caulk types. These caulks include Type 1A (subsets 1A1 and 1A2) and Type 1C (subsets 1C1 and 1C2). Additional sampling and testing of these materials will be conducted to better define the areal extents of the subset caulks such that mapping may be completed as follows:
  - Areas containing samples with consistent PCB concentrations will be mapped conservatively per the highest PCB concentration category of the consistent concentrations.
  - Areas such as the 2-62 slab that contain Type 1A samples with anomalous elevated concentrations of PCBs relative to the rest of the samples of that caulk type will be isolated and mapped as containing PCB concentrations in the category of the highest detected PCB concentrations.

Application of the above protocol to the caulk types identified during this investigation results in those caulk types being assigned to the PCB concentration categories as discussed below:

- **Type 1A:** Thirty-two samples collected in the 2-10, 2-40, and 2-60s/2-66 Areas contained PCB concentrations ranging from non-detect (at an RL of 0.79 ppm) to 39,000 ppm. Type 1A caulk was divided into two subsets based upon ranges of PCB concentrations:
  - **Type 1A1 Subset ( $\leq 25$  ppm PCBs):** Twenty-six samples collected in the 2-10, 2-40, and 2-60s/2-66 Areas contained PCB concentrations ranging from non-detect (at an RL of 0.79 ppm) to 14.5 ppm. The caulk will be mapped as containing  $>1$  ppm and  $\leq 25$  ppm PCBs, provided additional sampling and testing support the PCB range designation. The additional sampling and testing will be conducted to better define the areal extents of Type 1A1 caulk versus the areal extents of Type 1A2 caulk.



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- **Type 1A2 Subset (>50 ppm PCBs):** Five samples collected on the 2-62 slab and one sample collected near the southwest corner of Building 2-64 contained PCB concentrations ranging from 45.8 to 39,000 ppm. The caulk will be mapped as containing >50 ppm PCBs, and additional sampling and testing will be conducted to better define the areal extents of Type 1A2 caulk versus the areal extents of Type 1A1 caulk.
- **Type 1B:** Eighteen samples collected in the 2-10, 2-40, and 2-60s/2-66 Area were categorized as Type 1B caulk and contained PCB concentrations ranging from non-detect (at an RL of 0.79 ppm) to 8.1 ppm. Type 1B caulk will be mapped as containing >1 ppm and ≤25 ppm PCBs.
- **Type 1C:** Six samples collected in the 2-10 and 2-40 Areas were categorized as Type 1C caulk and contained PCB concentrations ranging from 7.8 to 40 ppm. None of this caulk type was observed in the 2-60s/2-66 Area during this investigation. The three samples collected in the 2-10 Area were located to the south and southwest of Building 2-10, and had PCB concentrations ranging from 29 to 40 ppm. The three samples collected in the 2-40 Area had PCB concentrations ranging from 7.8 to 12.3 ppm, somewhat lower than the PCB concentrations in the samples from the 2-10 Area. The difference in the range of PCB concentrations between the 2-10 and 2-40 Areas may be attributable to different production era batches of the same type of caulk material being applied during different construction eras (i.e. 1953 vs 1940/1941 respectively). Consistent with the PCB concentration ranges detected in the caulk samples from each area, Type 1C caulk was divided into two subsets:
  - **Type 1C1 Subset (>1 ppm and ≤25 ppm PCBs):** Three samples collected in the 2-40 Area had PCB concentrations ranging from 7.8 to 12.3 ppm. The caulk in the 2-40 Area will be mapped as containing >1 ppm and ≤25 ppm PCBs, provided additional sampling and testing support the PCB range designation. The additional sampling and testing will be conducted to better define the areal extents of Type 1C1 caulk versus the areal extents of Type 1C2 caulk.
  - **Type 1C2 Subset (>25 ppm and ≤50 ppm PCBs):** Three samples collected in the 2-10 Area had PCB concentrations ranging from 29 to 40 ppm. The caulk in the 2-10 Area will be mapped as containing >25 ppm and ≤50 ppm PCBs, provided additional sampling and testing support the PCB range designation. The additional sampling and testing will be conducted to better define the areal extents of Type 1C2 caulk versus the areal extents of Type 1C1 caulk.
- **Type 1D:** Only one sample was categorized as Type 1D caulk, and it was located in the 2-40 Area. The PCB concentration in the sample was 8.3 ppm. No other Type 1D caulk was found in the 2-10 or 2-60s/2-66 Areas during this investigation. Type 1D caulk will be mapped as containing >1 ppm and ≤25 ppm PCBs.
- **Type 1E:** Twenty-two samples collected in the 2-10, 2-40, and 2-60s/2-66 Area were categorized as Type 1E caulk and contained PCB concentrations ranging from non-detect (at an RL of 0.79 ppm) to 3.0 ppm. This caulk type was the most predominant caulk observed in the 2-40 Area. Type 1E caulk will be mapped in all areas as containing >1 ppm and ≤25 ppm PCBs.
- **Type 2A:** Nine samples were categorized as Type 2A caulk in the 2-10, 2-40, and 2-60s/2-66 Areas, and no PCBs were detected in any of the samples. However, due to chromatographic interference during the analyses of some of the samples, the RLs for the non-detected PCB concentrations ranged from 0.79 to 2.0 ppm. With RLs exceeding



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1 ppm, the Type 2A caulk will conservatively be mapped as containing >1 ppm and ≤25 ppm PCBs.

- **Type 2B:** Only one sample was categorized as Type 2B caulk, and it was located in the 2-10 Area. PCBs were not detected in the sample at an RL of 0.8 ppm. No other Type 2B caulk was found in the 2-40 or 2-60s/2-66 Areas during this investigation. Type 2B caulk will be designated as containing <1 ppm PCBs.
- **Type 2C:** Two samples were categorized as Type 2C caulk in the 2-60s/2-66 Area based upon their 2005/2006 descriptions, and were located on the 2-65 slab. PCB concentrations in the two samples were 29,300 ppm and 40,500 ppm. These concentrations are not consistent with the non-detected PCB concentration (at an RL of 0.79 ppm) in the only other Type 2C caulk sample that was identified during this investigation in the 2-40 Area during 2007. The high concentrations of PCBs in the two 2005/2006 Type 2C caulk samples from the 2-65 slab may be related to historical uses of the equipment foundation from which the samples were collected. Boeing removed all of the Type 2C caulk material from the equipment foundation on the 2-65 slab. Other than the 2007 sample located in the 2-40 Area, no other Type 2C caulk was observed in the 2-60s/2-66 Area or elsewhere onsite during this investigation. In accordance with the non-detected PCB concentration in the only other Type 2C caulk found during this investigation, Type 2C caulk will be mapped as containing <1 ppm PCBs.
- **Type 3:** Four samples collected in the 2-10 and 2-60s/2-66 Area were categorized as Type 3 caulk and contained PCB concentrations ranging from non-detect (at an RL of 0.79 ppm) to 2.2 ppm. PCBs were not detected (at RLs of up to 0.8 ppm) in the two samples collected in the 2-10 Area, and the PCB concentrations for the two samples collected in the 2-60s/2-66 Area contained PCB concentrations of non-detect (at an RL of 0.8 ppm) and 2.2 ppm. Due to the small range between the RLs and the detected PCB concentration of 2.2 ppm, Type 3 caulk will be conservatively mapped sitewide as containing >1 ppm and ≤25 ppm PCBs.
- **Type 4:** Six samples were categorized as Type 4 caulk, and all were located in the 2-60s/2-66 Area. Five of these samples had PCB concentrations that ranged from 5.2 to 27.0 ppm and one sample had an anomalous PCB concentration of 34,000 ppm. No other Type 4 caulk materials were found in the 2-10 or 2-40 Areas during this investigation. Some of the caulk containing the lower range of PCB concentrations was removed from the west side of Building 2-64 as a result of the demolition of that building. All of the caulk represented by the sample containing 34,000 ppm PCBs was located on and removed by Boeing from the equipment footing on the 2-65 slab where Type 2C caulk containing anomalous PCB concentrations was also removed. The high concentrations of PCBs in the Type 4 and Type 2C caulk samples collected at the equipment foundation on the 2-65 slab may be related to historical uses of the equipment foundation from which the samples were collected. Excluding the removed caulk, the remaining Type 4 caulk samples were located on the 2-65 and 2-66 slabs and contained PCB concentrations that ranged from 5.2 to 27.0 ppm. Type 4 caulk will be mapped as containing >25 ppm and ≤50 ppm PCBs.
- **Type 5:** Five samples, three of which were duplicates of the first two samples, were categorized as Type 5 caulk in the 2-60s/2-66 Area. PCBs were not detected in any of the samples as detailed in Section 3.1.2 above, but chromatographic interference during the analyses of the samples resulted in RLs ranging 9.6 to 9.9 ppm. With RLs exceeding 1 ppm, the Type 5 caulk will be conservatively mapped as containing >1 ppm and ≤25 ppm PCBs.



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- **Type 6:** Three samples collected in the 2-60s/2-66 Area were categorized as Type 6 caulk and contained PCB concentrations ranging from 6.2 to 10.0 ppm. Type 6 caulk type will be mapped in all areas as containing >1 ppm and ≤25 ppm PCBs.
- **Type 7:** Two samples collected in the 2-10 Area were categorized as Type 7 caulk, and contained PCB concentrations of non-detect (at an RL of 0.79 ppm) and 3.2 ppm. Type 7 caulk will be mapped as containing >1 ppm and ≤25 ppm PCBs.
- **Type 8A:** Three samples, two of which were duplicates of the first sample, were categorized as Type 8A caulk in the 2-60s/2-66 Area. PCBs were not detected in any of the samples as detailed in Section 3.1.2 above, but chromatographic interference during the analyses of the samples resulted in a final RL of 7.8 ppm. With the RL exceeding 1 ppm, the Type 8A caulk will be conservatively mapped as containing >1 ppm and ≤25 ppm PCBs.
- **Type 8B:** Two samples collected in the 2-60s/2-66 Area were categorized as Type 8B caulk, and contained PCB concentrations of 1.6 ppm and 2.7 ppm. Type 8B caulk will be mapped as containing >1 ppm and ≤25 ppm PCBs.

A tabular summary of the above caulk types and PCB concentration categories that will be used during mapping in Phase 2 of this IM is presented below:

Caulk Type	PCB Concentration Category
1A1	> 1 ppm & ≤ 25 ppm*
1A2	> 50 ppm*
1B	> 1 ppm & ≤ 25 ppm
1C1	> 1 ppm & ≤ 25 ppm*
1C2	> 25 ppm & ≤ 50 ppm*
1D	> 1 ppm & ≤ 25 ppm
1E	> 1 ppm & ≤ 25 ppm
2A	> 1 ppm & ≤ 25 ppm
2B	< 1 ppm
2C	< 1 ppm
3	> 1 ppm & ≤ 25 ppm
4	> 25 ppm & ≤ 50 ppm
5	> 1 ppm & ≤ 25 ppm
6	> 1 ppm & ≤ 25 ppm
7	> 1 ppm & ≤ 25 ppm
8A	> 1 ppm & ≤ 25 ppm
8B	> 1 ppm & ≤ 25 ppm

\*Subject to results of additional sampling and testing



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#### 3.5 Deviations from Work Plan

Minor deviations from the EPA-approved IM Work Plan occurred during the course of Phase 1 of this investigation. None of the deviations materially affected the intent or results of this investigation. EPA was promptly notified by Boeing after the necessity of each deviation was realized, and EPA approved each of the deviations. The deviations are summarized below:

- The numbering system for caulk samples collected in the 2-10 and 2-40 Areas was modified slightly to include the identification number of the sampling block from which each sample was collected.
- The numbering system that was used for sampling caulk materials in the 2-60s/2-66 Area during 2005/2006 was adopted for sampling caulk materials in that area during 2007.
- The schedule for submitting this Phase 1 Report was extended by three weeks, from January 9, 2008 to January 30, 2008, due to challenges that the analytical laboratory was experiencing in preparing the caulk samples for analyses.

EPA approved the deviations via email correspondence with Boeing, and Boeing documented the approval of the schedule extension in a letter to EPA dated December 11, 2007.

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#### 4.0 IM WORK PLAN PHASE 2 – REMAINING TASKS

##### 4.1 Caulk Mapping and Evaluation

Upon receipt of EPA comments and approval of this Phase 1 Report for the baseline characterization of caulk materials, detailed mapping of contaminated caulks, based upon the visual properties established by the baseline characterization, will be conducted in the 2-60s/2-66, 2-40, and 2-10 Areas. The mapping will be required to identify the specific locations of caulk materials containing > 1 ppm PCBs; to enable an evaluation of recent catch basin and stormwater sampling results versus the areas containing caulk with elevated concentrations of PCBs, such that stormwater source control issues can be better understood; and to enable recommendations regarding actions where deemed necessary, including prioritization of the most severely weathered caulk materials that require stabilization / removal.

##### 4.1.1 Detailed Mapping

The baseline characterization of caulk materials will be used to visually identify the concrete pavement/slab joints and cracks containing caulk with > 1 ppm PCBs in the 2-60s/2-66, 2-40, and 2-10 Areas. All caulk materials in the concrete pavements and slabs of the subject areas will be observed, and the locations and types of those materials characterized as containing > 1 ppm PCBs will be marked on a map of the site. The map will be used to further delineate the joints and cracks containing caulks with PCB concentrations between 25 ppm and 50 ppm, and caulks with PCB concentrations exceeding 50 ppm. Regional mapping, as opposed to individual mapping of joints and cracks, may be implemented in areas where the use of the same caulk material is widespread. In the event that previously uncharacterized caulk materials are discovered during the mapping process, the materials will be mapped, sampled, tested for PCBs, and characterized per the baseline characterization process.

Some concrete pavements at Plant 2, particularly the in the 2-60s/2-66 Area, are known to contain caulked cracks and joints that are too tightly spaced to reasonably map individually. In the event that caulks in tightly spaced cracks and joints are deemed to contain > 1 ppm PCBs, such locations will be regionally mapped as opposed to mapping the cracks individually. The mapping will, however, enable identification of the specific locations where the caulk materials contain elevated concentrations of PCBs.

##### 4.1.2 Additional Sampling and Testing

Additional sampling and testing of Type 1A and Type 1C caulk types will be conducted to determine the areal extents of the two subsets (Type 1A1/1A2 and Type 1C1/1C2) of each of these caulk types that were designated based upon PCB concentrations.

- **2-10 & 2-40 Area:** One sample of Type 1A caulk and/or one sample of Type 1C caulk will be collected in each odd-numbered sampling block where these materials are found, except for blocks where these caulk types were previously sampled. The sampling block locations are shown on Figure 3.
- **2-60s/2-66 Area:** Similar to the grid system of north-south and east-west trending lines and the resultant sampling blocks that were established on maps of the 2-10 and 2-40s Areas, a grid system and sampling blocks have been established on a map of the



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2-60s/2-66 Area. The grid system has been laid-out to segregate sampling blocks on building slabs from those on road or parking lot areas to reflect previous observations that the higher PCB concentrations were consistently associated with building slab caulk applications, as opposed to road or parking lot caulk applications. The template for the grid lines generally forms a series of 75-foot square blocks, however, due to pavement and slab configurations many of the blocks have irregular shapes. A total of 103 sampling blocks have been prescribed, and each block has been assigned a unique identification number. One sample of Type 1A caulk and/or one sample of Type 1C caulk will be collected in each odd-numbered sampling block where these materials are found, except for blocks where these caulk types were previously sampled. The sampling block locations are shown on Figure 3.

#### **4.1.3 Stormwater System Sampling Versus Caulk Sampling Results**

The mapped locations of caulk materials containing elevated concentrations of PCBs will be compared to the results of recent catch basin and stormwater sampling to evaluate determinations as to whether these caulk materials are potentially affecting stormwater quality. A map of the stormwater system will be overlaid on a map of the caulk material results to assist in this evaluation of potential cause-and-effect. Although these caulk materials may represent a source of PCBs to stormwater, the evaluation of stormwater sampling results versus caulk sampling results will not be a determining factor in the recommendations for caulk stabilization or removal under this IM Work Plan.

#### **4.2 Reporting**

Upon completion of the detailed mapping and evaluation of caulk materials, a Phase 2 Report will be prepared and submitted to EPA. The report will include maps of caulk materials containing the values and action categories of PCB concentrations, and recommendations of actions as required. The recommendations may range from "no action" to "stabilization" to "removal" based on direction specified in EPA's April 11, 2007 letter.

## Phase 1 Report and Work Plan

### Characterization of Caulk in Concrete Pavements at Boeing Plant 2

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#### 5.0 SCHEDULE

Phase 2 of the IM Work Plan includes detailed mapping of caulk materials throughout the 2-60s/2-66, 2-40 and 2-10 Areas based upon the baseline characterization established in this Phase 1 Report, sampling of caulk materials of other than the established types identified during the course of the detailed mapping, and the submittal of a Phase 2 Report to EPA identifying all caulk materials containing greater than 1 ppm PCBs. Phase 3 of this process will include the preparation of a subsequent IM Work Plan for the stabilization/removal of those caulk materials requiring such actions. The schedule for Phases 2 and 3 is presented below.

Task	Phase	Description	Due Date
1	Phase 2	Conduct detailed mapping and begin sampling of caulk materials.	Complete mapping within 10 weeks after EPA approval of Phase 1 Report and Work Plan.
2		Complete collection of samples of Types 1A and 1C, and additional caulk types identified during mapping, complete laboratory analysis, data validation, and database update.	Complete within 14 weeks after EPA approval of Phase 1 Report and Work Plan.
3		Submit Phase 2 Report.	Submit within 18 weeks after EPA approval of Phase 1 Report and Work Plan.
4	Phase 3	Prepare IM Work Plan for caulk stabilization / removal.	Submit within 30 days after EPA approval of Phase 2 Report.



**Phase 1 Report and Work Plan**  
**Characterization of Caulk in Concrete Pavements at Boeing Plant 2**

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**6.0 REFERENCES**

Floyd|Snider. 2005. Memorandum: Summary of Recent Storm System Solids Survey and Source Control Sampling at Plant 2. November.

Golder Associates, Inc. 2006. *Stormwater Source Control Work Plan for Boeing Plant 2*. October.

EPA letter to The Boeing Company, Re: *Determination of the Requirement for an Interim Measure*, EPA ID No WAD 00925 6819. February 15, 2007.

Boeing letter to EPA, Re: EPA letter dated February 15, 2007, February 26, 2007.

EPA letter to The Boeing Company, Re: *Clarification for the Determination of the Requirement for an Interim Measure*, EPA ID No WAD 00925 6819. April 11, 2007.

Golder Associates, Inc. *Draft Interim Measure Completion Report, Removal of Stormwater Lines X & Y (OA 23.1 and OA 23.2) at Boeing Plant 2*. July 2007.

Golder Associates, Inc. *Interim Measure Work Plan, Characterization of Caulk in Concrete Pavements at Boeing Plant 2*. August 2007a.

Golder Associates, Inc. 2007b. Stormwater Source Control Round 1 Sampling Report. 2006-2007. October.

Golder Associates, Inc. 2007c. Revised Stormwater Source Control Work Plan for Boeing Plant 2. December.

Boeing letter to EPA, Re: Report Due Date Extension, December 11, 2007.







Phase 1 Report and Work Plan  
Characterization of Caulk in Concrete Pavements at Boeing Plant 2

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TABLES



Table 1 - Plant 2 Caulk Sampling Summary - Sorted by Area, Caulk Type, and PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A1 results		1.7 - 10.3	5	NA	0	NA	0
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, conchoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-pliable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0
Totals				50		33		34

CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-10 AREA SAMPLES					
1A1	PL2IM-2-10-05-05-C	Poor, weathered/eroded, dirt & moss infilled	0.79	U	
1A1	PL2IM-2-10-20-02-C	Poor, weathered/eroded in most areas	3.30		
1A1	PL2IM-2-10-20-01-C	Fair, weathered/eroded in some areas	4.60		
1A1	PL2IM-2-10-20-01A-C (Dup of 10-20-01)	Fair, weathered/eroded in some areas	5.60		
1A1	PL2IM-2-10-44-03-C	Poor, some caulk missing from joint	7.60		
1A1	PL2IM-2-10-60-03-C	Fair, cracking	8.50		
1A1	PL2IM-2-10-05-03-C	Poor, weathered/eroded, dirt & moss infilled	11.30		
1A1	PL2IM-2-10-60-02A-C (Dup of 10-60-02)	Poor, weathered/eroded in many areas	11.90		
1A1	PL2IM-2-10-60-02-C	Poor, weathered/eroded in many areas	12.40		
1A1	PL2IM-2-10-05-02-C	Poor, partially weathered/eroded, dirt & moss infilled	14.50		
1B	PL2IM-2-10-55-03-C	Fair, partially weathered/eroded, dirt & moss infilled	0.79	U	
1B	PL2IM-2-10-32-01-C	Fair, some weathering/erosion	0.80	U	
1B	PL2IM-2-10-32-02-C	Fair, partially eroded in most areas	0.80	U	
1B	PL2IM-2-10-40-02-C	Poor, weathered/eroded in most areas, dirt & moss infilled.	0.80	U	
1B	PL2IM-2-10-40-03-C	Poor, weathered/eroded in most areas, dirt & moss infilled.	0.80	U	
1B	PL2IM-2-10-75-01-C	Fair, some cracking & weathering/erosion	3.80		
1B	PL2IM-2-10-75-02-C (Dup of 10-75-01)	Fair, some cracking & weathering/erosion	4.80		
1B	PL2IM-2-10-44-02-C	Poor, weathered/eroded in most areas; dirt, moss & grass infilled.	7.20		
1C2	PL2IM-2-10-75-04-C	Fair to poor, weathered/eroded in many areas	29.00		
1C2	PL2IM-2-10-75-03-C	Good	36.10		
1C2	PL2IM-2-10-65-02-C	Poor, weathered/eroded in many areas, dirt & rock infilled	40.00		
1E	PL2IM-2-10-80-01-C	Excellent	0.79	U	
1E	PL2IM-2-10-55-04-C	Fair, little to no weathering/erosion	0.80	U	
1E	PL2IM-2-10-80-02-C	Excellent	1.10		
1E	PL2IM-2-10-65-01-C	Good	2.50		
2A	PL2IM-2-10-05-04-C	Excellent	0.80	U	
2A	PL2IM-2-10-20-03-C	Excellent	1.90	U	
2A	PL2IM-2-10-20-04-C (Dup of 10-20-03)	Excellent	2.00	U	
2B	PL2IM-2-10-44-01-C	Fair, cracked & broken-out in some areas.	0.80	U	
3	PL2IM-2-10-55-02-C	Good	0.79	U	
3	PL2IM-2-10-55-01-C	Good	0.80	U	
7	PL2IM-2-10-65-03-C	Fair, cracked, used in spot treatments only, very limited distribution	0.79	U	
7	PL2IM-2-10-60-01-C	Fair, cracked, used in spot treatments only, very limited distribution	3.20		



Table 1 - Plant 2 Caulk Sampling Summary - Sorted by Area, Caulk Type, and PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A1 results		1.7 - 10.3	5	NA	0	NA	0
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, concoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-pliable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0
Totals				50		33		34

CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-40 AREA SAMPLES					
1A1	PL2IM-2-40-06-03-C	Poor, highly weathered/eroded, dirt & moss infilled	0.79	U	
1A1	PL2IM-2-40-08-01-C	Poor, highly weathered/eroded, dirt & moss infilled	0.92		
1A1	PL2IM-2-40-06-02-C	Fair, some weathering/erosion, dirt & moss infilled	0.99		
1A1	PL2IM-2-40-01-02-C	Fair, some weathering/erosion	7.50		
1A1	PL2IM-2-40-16-02-C	Poor, caulk only half fills joint, weathered/eroded; dirt, moss & grass infilled	10.30		
1B	PL2IM-2-40-24-02-C	Good	0.79	U	
1B	PL2IM-2-40-15-02-C	Poor, mostly weathered/eroded, dirt & moss infilled	0.80	U	
1B	PL2IM-2-40-24-03-C	Poor, weathered/eroded in many areas	0.80	U	
1B	PL2IM-2-40-24-04-C (Dup of 40-24-03)	Poor, weathered/eroded in many areas	0.80	U	
1B	PL2IM-2-40-18-01-C	Poor, weathered/eroded in many areas; dirt, moss & grass infilled	3.10		
1B	PL2IM-2-40-09-01-C	Fair to poor, weathered/eroded in some areas	5.00		
1C1	PL2IM-2-40-18-02-C	Good to fair	7.80		
1C1	PL2IM-2-40-19-03-C	Fair to good, slightly weathered/eroded	9.20		
1C1	PL2IM-2-40-19-03A-C (Dup of 40-19-03)	Fair to good, slightly weathered/eroded	12.30		
1D	PL2IM-2-40-16-01-C	Fair, some areas weathered/eroded	8.30		
1E	PL2IM-2-40-06-01-C	Good to fair, some dirt & moss infilling	0.79	U	
1E	PL2IM-2-40-08-02-C	Good, only slightly weathered	0.79	U	
1E	PL2IM-2-40-09-02-C	Good	0.79	U	
1E	PL2IM-2-40-10-03-C	Good	0.79	U	
1E	PL2IM-2-40-08-03-C (Dup of 40-08-02)	Good, only slightly weathered	0.80	U	
1E	PL2IM-2-40-19-02A-C (Dup of 40-19-02)	Good	0.80	U	
1E	PL2IM-2-40-15-01-C	Good	0.82		
1E	PL2IM-2-40-15-03-C	Good, slightly weathered	0.88		
1E	PL2IM-2-40-09-03-C	Good	0.89		
1E	PL2IM-2-40-10-04-C	Good	0.95		
1E	PL2IM-2-40-19-02-C	Good	1.10		
1E	PL2IM-2-40-09-05-C (Dup of 40-09-04)	Good	1.30		
1E	PL2IM-2-40-09-04-C	Good	1.40		
1E	PL2IM-2-40-10-01-C	Fair	1.50		
1E	PL2IM-2-40-10-02-C	Fair, weathered	3.00		
2A	PL2IM-2-40-01-03-C	Good	0.79	U	
2A	PL2IM-2-40-01-04-C	Fair, rubbery, easily pulled from joint	0.79	U	
2A	PL2IM-2-40-01-05-C	Fair, rubbery, easily pulled from joint	1.60	Y	
2C	PL2IM-2-40-01-01-C	Good, slightly weathered	0.79	U	



Table 1 - Plant 2 Caulk Sampling Summary - Sorted by Area, Caulk Type, and PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A1 results		1.7 - 10.3	5	NA	0	NA	0
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, concoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-pliable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0
Totals				50		33		34

CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-60s/2-66 AREA SAMPLES					
1A1	PL2-JM-Y-214-6	Poor, weathered/eroded, some dirt & moss infilling. Limited distribution in area.	0.79	U	
1A1	PL2-JM-X-215-3	Removed	0.80	U	Removed during recent construction activities
1A1	PL2-JM-X-215-2	Removed	1.81	J	Removed during recent construction activities
1A1	PL2-JM-Y-226-1	Fair, moderately weathered/eroded, dirt & moss infilled. Limited distribution in area.	4.00		
1A1	PL2-JM-Y-214-8	Poor, weathered/eroded, dirt & moss infilled. Limited distribution in area.	12.90		
1A1	PL2-JM-X-215-7	Good, minor weathering. Common distribution in area.	13.00		
Type 1A1 samples located on 2-62 Slab					
1A1	PL2-JM-Z-207-2	Poor, weathered/eroded. Common distribution in area.	1.70		Located on 2-62 Slab
1A1	PL2-JM-Z-207A-1	Poor, weathered/eroded, dirt & moss infilled. Common distribution in area.	4.10		Located on 2-62 Slab
1A1	PL2-JM-Z-207A-2 (Dup of 207A-1)	Poor, weathered/eroded, dirt & moss infilled. Common distribution in area.	5.10		Located on 2-62 Slab
1A1	PL2-JM-Z-207A-3	Poor, weathered/eroded. Common distribution in area.	5.60		Located on 2-62 Slab
1A1	PL2-JM-Z-207-1	Poor, eroded & cracked, dirt & moss infilled. Common distribution in area.	10.30		Located on 2-62 Slab
Type 1A2 samples located on 2-62 Slab or near PCB RCRA Unit & containing elevated concentrations of PCBs					
1A2	PL2-JM-Z-210-1	Poor, eroded & cracked, dirt & moss infilled. Common distribution in area.	45.80	J	Located on 2-62 Slab
1A2	PL2-JM-Z-212-3 (Dup of 212-2)	Poor, weathered/eroded; dirt, moss & grass infilled. Common distribution in area	68.00		Located on 2-62 Slab
1A2	PL2-JM-Z-212-2	Poor, weathered/eroded; dirt, moss & grass infilled. Common distribution in area	110.00		Located on 2-62 Slab
1A2	PL2-JM-X-215-1	Removed	740.00		Removed from 2-64 during recent construction activities
1A2	PL2-JM-Y-204-1	Fair, weathered, dirt & moss infilling. Common distribution in area.	29000.00		Located on 2-62 Slab
1A2	PL2-JM-Z-735-1	Poor, weathered/eroded, dirt, moss & grass infilled. Limited distribution in area.	39000.00		Located on 2-62 Slab
1B	PL2-JM-X-233-1	Poor - Fair, weathered/eroded, dirt infilled. Common distribution in area.	2.50		
1B	PL2-JM-Y-214-1	Poor - Fair, some weathering/erosion, dirt & moss infilled. Common distribution in area.	2.50		
1B	PL2-JM-Y-214-2	Removed	2.70		Removed during recent construction activities
1B	PL2-JM-X-215-4	Fair, some weathering/erosion, dirt & moss infilled. Limited distribution in area.	8.10		
1E	PL2-JM-Z-212-4 (Dup of 212-1)	Fair, cracked/segmented. Common distribution on area roads.	0.79	U	
1E	PL2-JM-Z-212-1	Fair, cracked/segmented. Common distribution on area roads.	1.20	U	
1E	PL2-JM-Z-154-2	Poor - Fair, cracked/segmented. Common distribution on area roads.	1.40		
2A	PL2-JM-V-189-1	Good. Common distribution in area.	0.80	U	
2A	PL2-JM-Z-213-1	Good. Common distribution in area.	0.80	U	
2A	PL2-JM-Z-706-1	Good. Common distribution in area.	0.80	U	
2C	PL2-JM-Y-214-3	Removed	29300.00	J	Voluntarily removed by Boeing
2C	PL2-JM-Y-214-4	Removed	40500.00	J	Voluntarily removed by Boeing
3	PL2-JM-V-188-1	Fair - Good, moss covered. Limited distribution in area.	0.80	U	
3	PL2-JM-Z-138-1	Good. Common distribution in area.	2.20	J	



Table 1 - Plant 2 Caulk Sampling Summary - Sorted by Area, Caulk Type, and PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A1 results		1.7 - 10.3	5	NA	0	NA	0
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, concoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-piable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0
Totals				50		33		34

CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-60s/2-66 AREA SAMPLES (continued)					
4	PL2-JM-X-215-6	Fair, little weathering/erosion, dirt infilled. Common distribution in area.	5.20		
4	PL2-JM-Y-214-5	Fair, some weathering/erosion, dirt infilled. Common distribution in area.	8.60		
4	PL2-JM-Y-225-1	Poor, highly weathered/eroded; dirt & moss infilled. Limited-common distribution.	13.90		
4	PL2-JM-X-215-5	Removed	13.90		Removed during recent construction activities
4	PL2-JM-X-233-2	Fair, moderately weathered/eroded. Common distribution in area.	27.00		
4	PL2-JM-Y-214-10	Removed	34000.00		Voluntarily removed by Boeing
5	PL2-JM-Z-138-3 (Dup of 138-2)	Poor, weathered/eroded, dirt infilled. Common distribution in area.	16.00	U	*16U PCB superseded by 9.6Y (PL2-JM-Z-138-4)
5	PL2-JM-X-220-1	Poor, weathered/eroded. Common distribution in area.	55.00	U	*55U PCB superseded by 9.9Y (PL2-JM-X-220-2)
5	PL2-JM-Z-138-2	Poor, weathered/eroded, dirt infilled. Common distribution in area.	80.00	U	*80U PCB superseded by 9.6Y (PL2-JM-Z-138-4)
5	PL2-JM-X-220-2 (Dup of 220-1)	Poor, weathered/eroded. Common distribution in area.	9.90	Y	
5	PL2-JM-Z-138-4 (Dup of 138-2 & 138-3)	Poor, weathered/eroded, dirt infilled. Common distribution in area.	9.60	Y	
6	PL2-JM-X-202-2	Poor, not exposed, underlies PL2-JM-X-202-1.	6.20		
6	PL2-JM-X-235-1	Poor, weathered/eroded; dirt, moss, & grass infilled. Very limited distribution in area.	6.30		
6	PL2-JM-X-202-1	Poor, weathered/eroded, dirt & gravel infilled. Very limited distribution in area.	10.00		
8A	PL2-JM-Z-154-3 (Dup of 154-1)	Fair, some weathering. Common distribution on sidewalk in area.	400.00	U	*400U PCB superseded by 7.8Y (PL2-JM-Z-154-4)
8A	PL2-JM-Z-154-4 (Dup of 154-1 & 154-3)	Fair, some weathering. Common distribution on sidewalk in area.	7.80	Y	
8A	PL2-JM-Z-154-1	Fair, some weathering. Common distribution on sidewalk in area.	560.00	U	*560U PCB superseded by 7.8Y (PL2-JM-Z-154-4)
8B	PL2-JM-Y-214-7	Poor, some weathering/erosion, dirt & moss infilled. Very limited distribution in area.	1.59	J	
8B	PL2-JM-Y-214-9	Poor, some weathering/erosion, dirt & moss infilled. Very limited distribution in area.	2.70		

Notes:                \* Shading indicates that the Reporting Limit was lowered and thereby superseded by analytical results for a duplicate sample. An extra cleaning step was used in the sample preparation of the duplicate sample to reduce chromatographic interference that caused the elevated Reporting Limits in the superseded results.



Table 2: Plant 2 Caulk Sampling Summary - All Areas Combined, Sorted by Caulk Type &amp; PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area		All Areas Combined	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5	0.8U - 14.5	21
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A results		1.7 - 10.3	5	NA	0	NA	0	1.7 - 10.3	5
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0	45.8 - 39000	6
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, conchoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6	0.8U - 8.1	18
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0	29.0 - 40.0	3
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-pliable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15	0.8U - 3.0	22
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3	0.8U - 2.0U	9
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0	0.8U	1
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1	0.8U - 40500	3
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0	0.8U - 2.2	4
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0	5.2 - 34000	6
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0	9.6Y - 9.9Y	5
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0	6.2 - 10.0	3
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0	0.8U - 3.2	2
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0	7.8Y	3
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0	1.6 - 2.7	2
Totals				50		33		34		117

## 2-10, 2-40, &amp; 2-60s/2-66 Area Samples

Area*	CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-10	1A1	PL2IM-2-10-05-05-C	Poor, weathered/eroded, dirt & moss infilled	0.79	U	
2-40	1A1	PL2IM-2-40-06-03-C	Poor, highly weathered/eroded, dirt & moss infilled	0.79	U	
2-60	1A1	PL2-JM-Y-214-6	Poor, weathered/eroded, some dirt & moss infilling. Limited distribution in area.	0.79	U	
2-60	1A1	PL2-JM-X-215-3	Removed	0.80	U	Removed during recent construction activities
2-40	1A1	PL2IM-2-40-08-01-C	Poor, highly weathered/eroded, dirt & moss infilled	0.92		
2-40	1A1	PL2IM-2-40-06-02-C	Fair, some weathering/erosion, dirt & moss infilled	0.99		
2-60	1A1	PL2-JM-X-215-2	Removed	1.81	J	Removed during recent construction activities
2-10	1A1	PL2IM-2-10-20-02-C	Poor, weathered/eroded in most areas	3.30		
2-60	1A1	PL2-JM-Y-226-1	Fair, moderately weathered/eroded, dirt & moss infilled. Limited distribution in area.	4.00		
2-10	1A1	PL2IM-2-10-20-01-C	Fair, weathered/eroded in some areas	4.60		
2-10	1A1	PL2IM-2-10-20-01A-C (Dup of 10-20-01)	Fair, weathered/eroded in some areas	5.60		
2-40	1A1	PL2IM-2-40-01-02-C	Fair, some weathering/erosion	7.50		
2-10	1A1	PL2IM-2-10-44-03-C	Poor, some caulk missing from joint	7.60		
2-10	1A1	PL2IM-2-10-60-03-C	Fair, cracking	8.50		
2-40	1A1	PL2IM-2-40-16-02-C	Poor, caulk only half fills joint, weathered/eroded; dirt, moss & grass infilled	10.30		
2-10	1A1	PL2IM-2-10-05-03-C	Poor, weathered/eroded, dirt & moss infilled	11.30		
2-10	1A1	PL2IM-2-10-60-02A-C (Dup of 10-60-02)	Poor, weathered/eroded in many areas	11.90		
2-10	1A1	PL2IM-2-10-60-02-C	Poor, weathered/eroded in many areas	12.40		
2-60	1A1	PL2-JM-Y-214-8	Poor, weathered/eroded, dirt & moss infilled. Limited distribution in area.	12.90		
2-60	1A1	PL2-JM-X-215-7	Good, minor weathering. Common distribution in area.	13.00		
2-10	1A1	PL2IM-2-10-05-02-C	Poor, partially weathered/eroded, dirt & moss infilled	14.50		
<b>Type 1A1 samples located on 2-62 Slab</b>						
2-60	1A1	PL2-JM-Z-207-2	Poor, weathered/eroded. Common distribution in area.	1.70		Located on 2-62 Slab
2-60	1A1	PL2-JM-Z-207A-1	Poor, weathered/eroded, dirt & moss infilled. Common distribution in area.	4.10		Located on 2-62 Slab
2-60	1A1	PL2-JM-Z-207A-2 (Dup of 207A-1)	Poor, weathered/eroded, dirt & moss infilled. Common distribution in area.	5.10		Located on 2-62 Slab
2-60	1A1	PL2-JM-Z-207A-3	Poor, weathered/eroded. Common distribution in area.	5.60		Located on 2-62 Slab
2-60	1A1	PL2-JM-Z-207-1	Poor, eroded & cracked, dirt & moss infilled. Common distribution in area.	10.30		Located on 2-62 Slab
<b>Type 1A2 samples located on 2-62 Slab or near PCB RCRA Unit</b>						
2-60	1A2	PL2-JM-Z-210-1	Poor, eroded & cracked, dirt & moss infilled. Common distribution in area.	45.80	J	Located on 2-62 Slab
2-60	1A2	PL2-JM-Z-212-3 (Dup of 212-2)	Poor, weathered/eroded; dirt, moss & grass infilled. Common distribution in area	68.00		Located on 2-62 Slab
2-60	1A2	PL2-JM-Z-212-2	Poor, weathered/eroded; dirt, moss & grass infilled. Common distribution in area	110.00		Located on 2-62 Slab
2-60	1A2	PL2-JM-X-215-1	Removed	740.00		Removed from 2-64 during recent construction activities
2-60	1A2	PL2-JM-Y-204-1	Fair, weathered, dirt & moss infilling. Common distribution in area.	29000.00		Located on 2-62 Slab
2-60	1A2	PL2-JM-Z-735-1	Poor, weathered/eroded, dirt, moss & grass infilled. Limited distribution in area.	39000.00		Located on 2-62 Slab



Table 2: Plant 2 Caulk Sampling Summary - All Areas Combined, Sorted by Caulk Type &amp; PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area		All Areas Combined	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5	0.8U - 14.5	21
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A results		1.7 - 10.3	5	NA	0	NA	0	1.7 - 10.3	5
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0	45.8 - 39000	6
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, conchoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6	0.8U - 8.1	18
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0	29.0 - 40.0	3
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-pliable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15	0.8U - 3.0	22
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3	0.8U - 2.0U	9
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0	0.8U	1
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1	0.8U - 40500	3
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0	0.8U - 2.2	4
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0	5.2 - 34000	6
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0	9.6Y - 9.9Y	5
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0	6.2 - 10.0	3
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0	0.8U - 3.2	2
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0	7.8Y	3
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0	1.6 - 2.7	2
Totals				50		33		34		117

## 2-10, 2-40, &amp; 2-60s/2-66 Area Samples

Area*	CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-10	1B	PL2IM-2-10-55-03-C	Fair, partially weathered/eroded, dirt & moss infilled	0.79	U	
2-40	1B	PL2IM-2-40-24-02-C	Good	0.79	U	
2-10	1B	PL2IM-2-10-32-01-C	Fair, some weathering/erosion	0.80	U	
2-10	1B	PL2IM-2-10-32-02-C	Fair, partially eroded in most areas	0.80	U	
2-10	1B	PL2IM-2-10-40-02-C	Poor, weathered/eroded in most areas, dirt & moss infilled.	0.80	U	
2-10	1B	PL2IM-2-10-40-03-C	Poor, weathered/eroded in most areas, dirt & moss infilled.	0.80	U	
2-40	1B	PL2IM-2-40-15-02-C	Poor, mostly weathered/eroded, dirt & moss infilled	0.80	U	
2-40	1B	PL2IM-2-40-24-03-C	Poor, weathered/eroded in many areas	0.80	U	
2-40	1B	PL2IM-2-40-24-04-C (Dup of 40-24-03)	Poor, weathered/eroded in many areas	0.80	U	
2-60	1B	PL2-JM-X-233-1	Poor - Fair, weathered/eroded, dirt infilled. Common distribution in area.	2.50		
2-60	1B	PL2-JM-Y-214-1	Poor - Fair, some weathering/erosion, dirt & moss infilled. Common distribution in area.	2.50		
2-60	1B	PL2-JM-Y-214-2	Removed	2.70		Removed during recent construction activities
2-40	1B	PL2IM-2-40-18-01-C	Poor, weathered/eroded in many areas; dirt, moss & grass infilled	3.10		
2-10	1B	PL2IM-2-10-75-01-C	Fair, some cracking & weathering/erosion	3.80		
2-10	1B	PL2IM-2-10-75-02-C (Dup of 10-75-01)	Fair, some cracking & weathering/erosion	4.80		
2-40	1B	PL2IM-2-40-09-01-C	Fair to poor, weathered/eroded in some areas	5.00		
2-10	1B	PL2IM-2-10-44-02-C	Poor, weathered/eroded in most areas; dirt, moss & grass infilled.	7.20		
2-60	1B	PL2-JM-X-215-4	Fair, some weathering/erosion, dirt & moss infilled. Limited distribution in area.	8.10		
Type 1C samples located in 2-40 Area						
2-40	1C1	PL2IM-2-40-18-02-C	Good to fair	7.80		
2-40	1C1	PL2IM-2-40-19-03-C	Fair to good, slightly weathered/eroded	9.20		
2-40	1C1	PL2IM-2-40-19-03A-C (Dup of 40-19-03)	Fair to good, slightly weathered/eroded	12.30		
Type 1C samples located in 2-10 Area						
2-10	1C2	PL2IM-2-10-75-04-C	Fair to poor, weathered/eroded in many areas	29.00		
2-10	1C2	PL2IM-2-10-75-03-C	Good	36.10		
2-10	1C2	PL2IM-2-10-65-02-C	Poor, weathered/eroded in many areas, dirt & rock infilled	40.00		
2-40	1D	PL2IM-2-40-16-01-C	Fair, some areas weathered/eroded	8.30		



Table 2: Plant 2 Caulk Sampling Summary - All Areas Combined, Sorted by Caulk Type & PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area		All Areas Combined	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5	0.8U - 14.5	21
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A results		1.7 - 10.3	5	NA	0	NA	0	1.7 - 10.3	5
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0	45.8 - 39000	6
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, conchoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6	0.8U - 8.1	18
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0	29.0 - 40.0	3
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-pliable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15	0.8U - 3.0	22
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3	0.8U - 2.0U	9
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0	0.8U	1
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1	0.8U - 40500	3
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0	0.8U - 2.2	4
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0	5.2 - 34000	6
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0	9.6Y - 9.9Y	5
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0	6.2 - 10.0	3
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0	0.8U - 3.2	2
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0	7.8Y	3
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0	1.6 - 2.7	2
Totals				50		33		34		117

2-10, 2-40, & 2-60s/2-66 Area Samples

Area*	CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-10	1E	PL2IM-2-10-80-01-C	Excellent	0.79	U	
2-40	1E	PL2IM-2-40-06-01-C	Good to fair, some dirt & moss infilling	0.79	U	
2-40	1E	PL2IM-2-40-08-02-C	Good, only slightly weathered	0.79	U	
2-40	1E	PL2IM-2-40-09-02-C	Good	0.79	U	
2-40	1E	PL2IM-2-40-10-03-C	Good	0.79	U	
2-60	1E	PL2-JM-Z-212-4 (Dup of 212-1)	Fair, cracked/segmented. Common distribution on area roads.	0.79	U	
2-10	1E	PL2IM-2-10-55-04-C	Fair, little to no weathering/erosion	0.80	U	
2-40	1E	PL2IM-2-40-08-03-C (Dup of 40-08-02)	Good, only slightly weathered	0.80	U	
2-40	1E	PL2IM-2-40-19-02A-C (Dup of 40-19-02)	Good	0.80	U	
2-40	1E	PL2IM-2-40-15-01-C	Good	0.82		
2-40	1E	PL2IM-2-40-15-03-C	Good, slightly weathered	0.88		
2-40	1E	PL2IM-2-40-09-03-C	Good	0.89		
2-40	1E	PL2IM-2-40-10-04-C	Good	0.95		
2-10	1E	PL2IM-2-10-80-02-C	Excellent	1.10		
2-40	1E	PL2IM-2-40-19-02-C	Good	1.10		
2-60	1E	PL2-JM-Z-212-1	Fair, cracked/segmented. Common distribution on area roads.	1.20	U	
2-40	1E	PL2IM-2-40-09-05-C (Dup of 40-09-04)	Good	1.30		
2-40	1E	PL2IM-2-40-09-04-C	Good	1.40		
2-60	1E	PL2-JM-Z-154-2	Poor - Fair, cracked/segmented. Common distribution on area roads.	1.40		
2-40	1E	PL2IM-2-40-10-01-C	Fair	1.50		
2-10	1E	PL2IM-2-10-65-01-C	Good	2.50		
2-40	1E	PL2IM-2-40-10-02-C	Fair, weathered	3.00		
2-40	2A	PL2IM-2-40-01-03-C	Good	0.79	U	
2-40	2A	PL2IM-2-40-01-04-C	Fair, rubbery, easily pulled from joint	0.79	U	
2-10	2A	PL2IM-2-10-05-04-C	Excellent	0.80	U	
2-60	2A	PL2-JM-V-189-1	Good. Common distribution in area.	0.80	U	
2-60	2A	PL2-JM-Z-213-1	Good. Common distribution in area.	0.80	U	
2-60	2A	PL2-JM-Z-706-1	Good. Common distribution in area.	0.80	U	
2-40	2A	PL2IM-2-40-01-05-C	Fair, rubbery, easily pulled from joint	1.60	Y	
2-10	2A	PL2IM-2-10-20-03-C	Excellent	1.90	U	
2-10	2A	PL2IM-2-10-20-04-C (Dup of 10-20-03)	Excellent	2.00	U	



Table 2: Plant 2 Caulk Sampling Summary - All Areas Combined, Sorted by Caulk Type &amp; PCB Concentration

CAULK TYPE	COLOR	DESCRIPTION	2-60s/2-66 Area		2-10 Area		2-40 Area		All Areas Combined	
			PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples	PCB Range (ppm)	No. of Samples
1A1	Dull black	Stiff - hard. Fresh surface black, glassy, rough, crumbly	0.8U - 13.0	6	0.8U - 14.5	10	0.8U - 10.3	5	0.8U - 14.5	21
1A1	Same as above, located in 2-60s Area on 2-62 Slab, PCB concentrations consistent with the above Type 1A results		1.7 - 10.3	5	NA	0	NA	0	1.7 - 10.3	5
1A2	Visually same as 1A1, but anomalous elevated PCB concentrations, located in 2-60s Area on 2-62 Slab or near Bldg 2-64		45.8 - 39000	6	NA	0	NA	0	45.8 - 39000	6
1B	Dull black	Stiff - hard, brittle. Fresh surface black, glassy, conchoidal fracture.	2.5 - 8.1	4	0.8U - 7.2	8	0.8U - 5.0	6	0.8U - 8.1	18
1C1	Dull black	2-40 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	NA	0	7.8 - 12.3	3	7.8 - 12.3	3
1C2	Dull black	2-10 Area only. Type 1A, but includes metal shavings, small screws, etc. in caulk matrix	NA	0	29.0 - 40.0	3	NA	0	29.0 - 40.0	3
1D	Dull black	Same as Type 1A, but pliable to semi-pliable. Fresh surface black, glassy, rough	NA	0	NA	0	8.3	1	8.3	1
1E	Dull black	Soft - stiff, pliable - semi-pliable. Fresh surface dull - semi glossy black, smooth - rough.	0.8U - 1.4	3	0.8U - 2.5	4	0.8U - 3.0	15	0.8U - 3.0	22
2A	Light gray	Soft - stiff, pliable, spongy - rubbery	0.8U	3	0.8U - 2.0U	3	0.8U - 1.6Y	3	0.8U - 2.0U	9
2B	Light gray	Strong, very stiff - very hard, brittle	NA	0	0.8U	1	NA	0	0.8U	1
2C	Dull gray	Stiff - hard, pliable	29300 - 40500	2	NA	0	0.8U	1	0.8U - 40500	3
3	Brown to Black	Soft - firm, pliable & spongy	0.8U - 2.2	2	0.8U	2	NA	0	0.8U - 2.2	4
4	Dull brown or black	Soft, fibrous, friable	5.2 - 34000	6	NA	0	NA	0	5.2 - 34000	6
5	Brown	Soft, pliable, spongy, stretchy, sticky	9.6Y - 9.9Y	5	NA	0	NA	0	9.6Y - 9.9Y	5
6	Reddish brown to black	Stiff, semi-pliable. Fresh surface smooth, yellow/brown/orange	6.2 - 10.0	3	NA	0	NA	0	6.2 - 10.0	3
7	Amber	Smooth, translucent, very hard, glassy	NA	0	0.8U - 3.2	2	NA	0	0.8U - 3.2	2
8A	White	Soft - stiff, pliable, spongy	7.8Y	3	NA	0	NA	0	7.8Y	3
8B	White	Firm - stiff, finely wrinkled, cracked. Fresh surface smooth, dull grayish-white	1.6 - 2.7	2	NA	0	NA	0	1.6 - 2.7	2
Totals				50		33		34		117

## 2-10, 2-40, &amp; 2-60s/2-66 Area Samples

Area*	CAULK TYPE	SAMPLE NUMBER	GENERAL CONDITION OF CAULK IN JOINT	PCBs (ppm)	Q	COMMENTS
2-10	2B	PL2IM-2-10-44-01-C	Fair, cracked & broken-out in some areas.	0.80	U	
2-40	2C	PL2IM-2-40-01-01-C	Good, slightly weathered	0.79	U	
2-60	2C	PL2-JM-Y-214-3	Removed	29300.00	J	Voluntarily removed by Boeing
2-60	2C	PL2-JM-Y-214-4	Removed	40500.00	J	Voluntarily removed by Boeing
2-10	3	PL2IM-2-10-55-02-C	Good	0.79	U	
2-10	3	PL2IM-2-10-55-01-C	Good	0.80	U	
2-60	3	PL2-JM-V-188-1	Fair - Good, moss covered. Limited distribution in area.	0.80	U	
2-60	3	PL2-JM-Z-138-1	Good. Common distribution in area.	2.20	J	
2-60	4	PL2-JM-X-215-6	Fair, little weathering/erosion, dirt infilled. Common distribution in area.	5.20		
2-60	4	PL2-JM-Y-214-5	Fair, some weathering/erosion, dirt infilled. Common distribution in area.	8.60		
2-60	4	PL2-JM-X-215-5	Removed	13.90		Removed during recent construction activities
2-60	4	PL2-JM-Y-225-1	Poor, highly weathered/eroded; dirt & moss infilled. Limited-common distribution.	13.90		
2-60	4	PL2-JM-X-233-2	Fair, moderately weathered/eroded. Common distribution in area.	27.00		
2-60	4	PL2-JM-Y-214-10	Removed	34000.00		Voluntarily removed by Boeing
2-60	5	PL2-JM-Z-138-4 (Dup of 138-2 & 138-3)	Poor, weathered/eroded, dirt infilled. Common distribution in area.	9.60	Y	
2-60	5	PL2-JM-X-220-2 (Dup of 220-1)	Poor, weathered/eroded. Common distribution in area.	9.90	Y	
2-60	5	PL2-JM-Z-138-3 (Dup of 138-2)	Poor, weathered/eroded, dirt infilled. Common distribution in area.	16.00	U	**16U PCB superseded by 9.6Y (PL2-JM-Z-138-4)
2-60	5	PL2-JM-X-220-1	Poor, weathered/eroded. Common distribution in area.	55.00	U	**55U PCB superseded by 9.9Y (PL2-JM-X-220-2)
2-60	5	PL2-JM-Z-138-2	Poor, weathered/eroded, dirt infilled. Common distribution in area.	80.00	U	**80U PCB superseded by 9.6Y (PL2-JM-Z-138-4)
2-60	6	PL2-JM-X-202-2	Poor, not exposed, underlies PL2-JM-X-202-1.	6.20		
2-60	6	PL2-JM-X-235-1	Poor, weathered/eroded; dirt, moss, & grass infilled. Very limited distribution in area.	6.30		
2-60	6	PL2-JM-X-202-1	Poor, weathered/eroded, dirt & gravel infilled. Very limited distribution in area.	10.00		
2-10	7	PL2IM-2-10-65-03-C	Fair, cracked, used in spot treatments only, very limited distribution	0.79	U	
2-10	7	PL2IM-2-10-60-01-C	Fair, cracked, used in spot treatments only, very limited distribution	3.20		
2-60	8A	PL2-JM-Z-154-4 (Dup of 154-1 & 154-3)	Fair, some weathering. Common distribution on sidewalk in area.	7.80	Y	
2-60	8A	PL2-JM-Z-154-3 (Dup of 154-1)	Fair, some weathering. Common distribution on sidewalk in area.	400.00	U	**400U PCB superseded by 7.8Y (PL2-JM-Z-154-4)
2-60	8A	PL2-JM-Z-154-1	Fair, some weathering. Common distribution on sidewalk in area.	560.00	U	**560U PCB superseded by 7.8Y (PL2-JM-Z-154-4)
2-60	8B	PL2-JM-Y-214-7	Poor, some weathering/erosion, dirt & moss infilled. Very limited distribution in area.	1.59	J	
2-60	8B	PL2-JM-Y-214-9	Poor, some weathering/erosion, dirt & moss infilled. Very limited distribution in area.	2.70		

Notes: \* 2-60 refers to 2-60s/2-66 Area

\*\* Shading indicates that the Reporting Limit was lowered and thereby superseded by analytical results for a duplicate sample. An extra cleaning step was used in the sample preparation of the duplicate sample to reduce chromatographic interference that caused the elevated Reporting Limits in the superseded results.





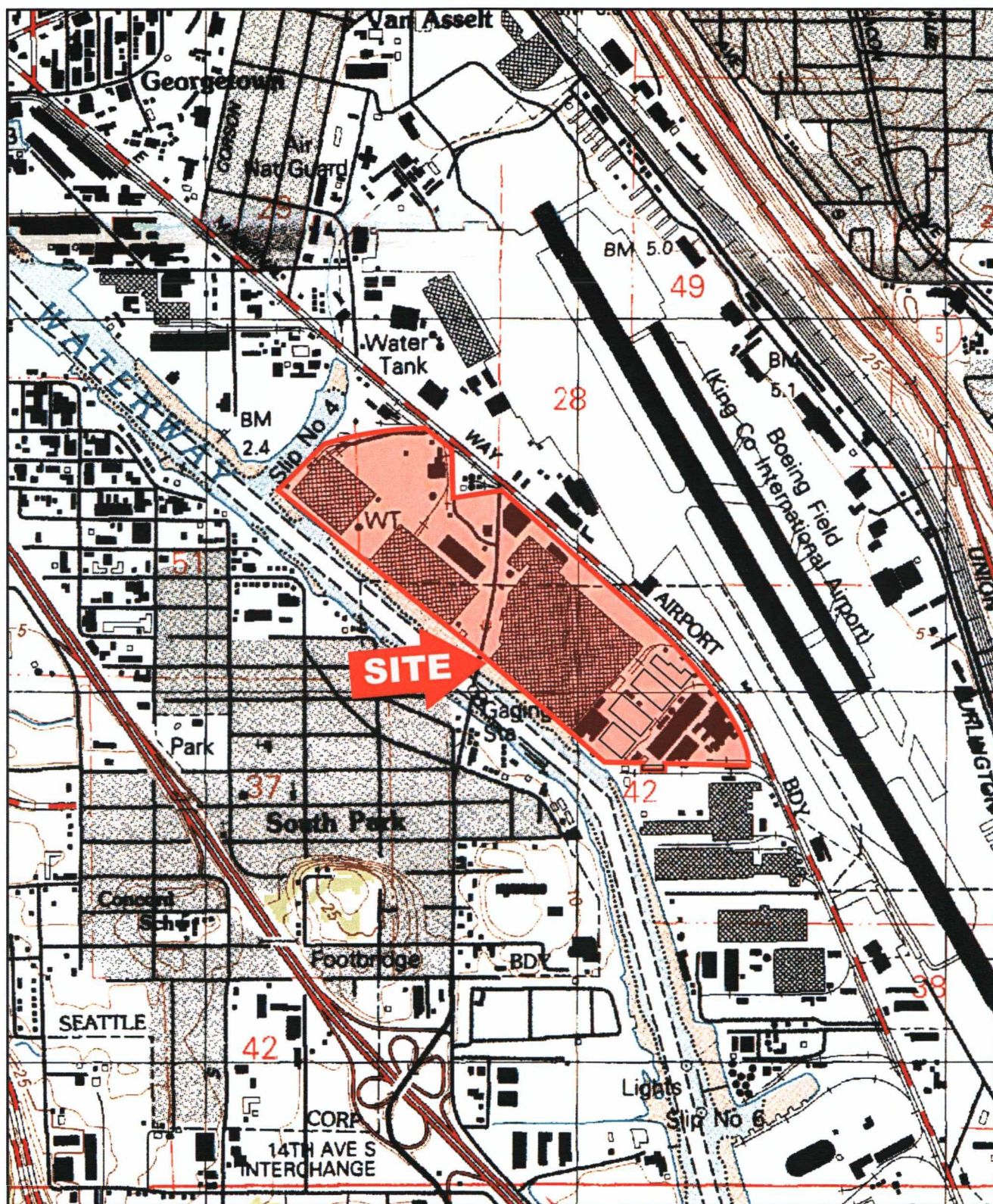


**Phase 1 Report and Work Plan**  
**Characterization of Caulk in Concrete Pavements at Boeing Plant 2**

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**FIGURES**





Characterization of Caulk In Concrete  
IM Work Plan  
Boeing Plant 2  
Seattle/Tukwila, Washington

Figure 1  
Vicinity Map

SHEET	DRAWN BY	REVIEWED BY	DATE
1 of 1	JDD	SAM	05/17/07



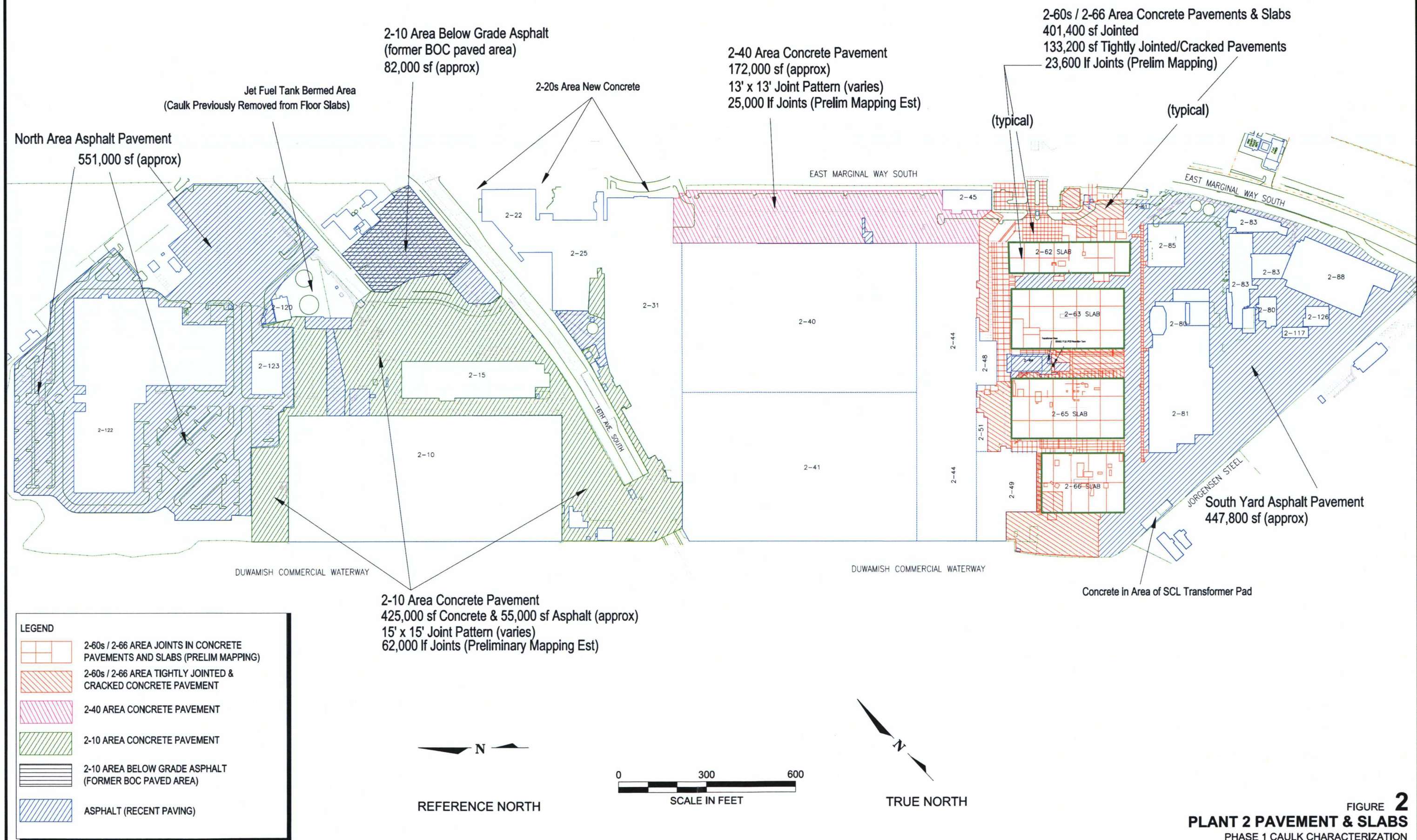


FIGURE 2  
**PLANT 2 PAVEMENT & SLABS**  
PHASE 1 CAULK CHARACTERIZATION







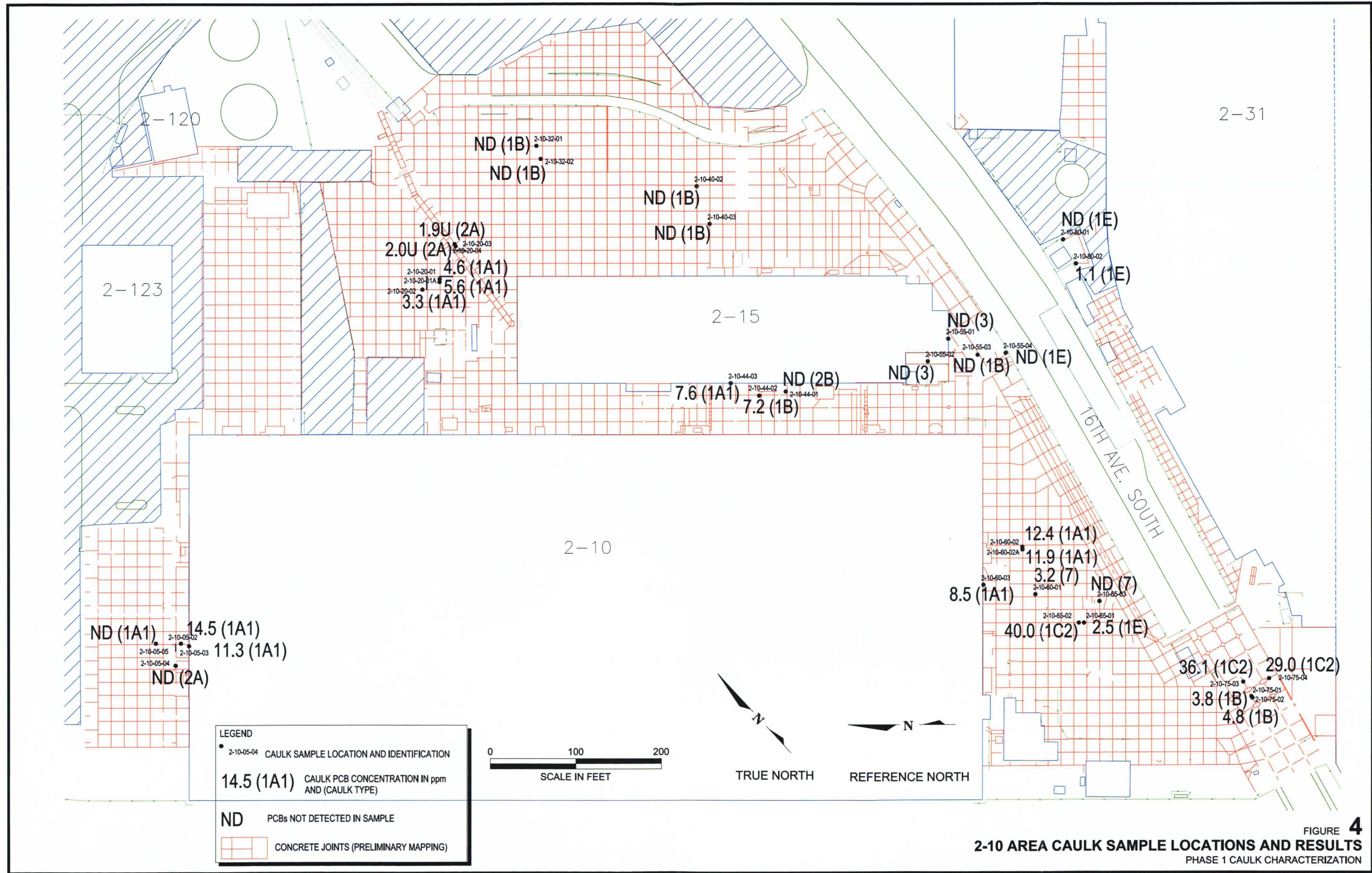


FIGURE 4  
2-10 AREA CAULK SAMPLE LOCATIONS AND RESULTS  
PHASE 1 CAULK CHARACTERIZATION  
Golder Associates



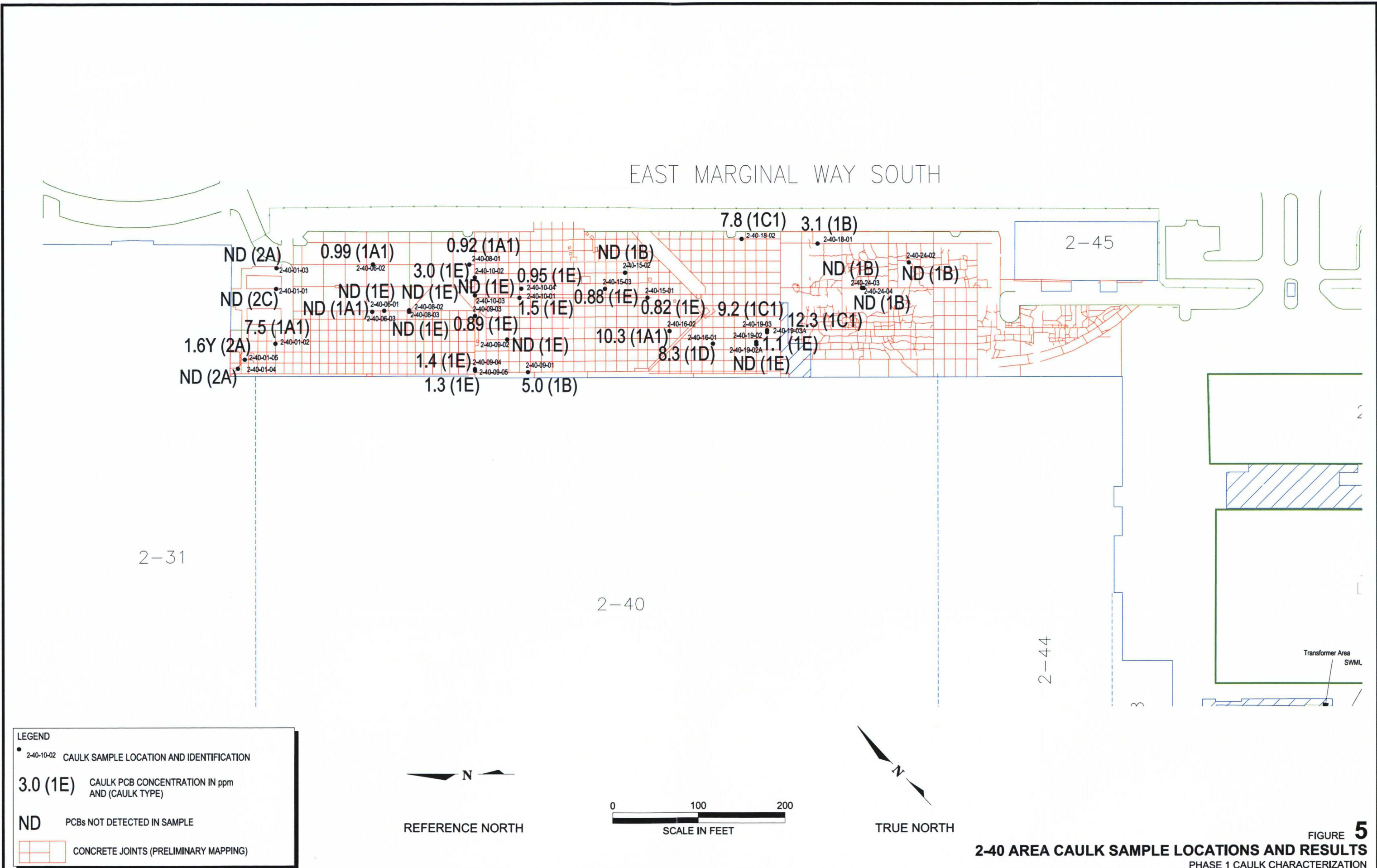
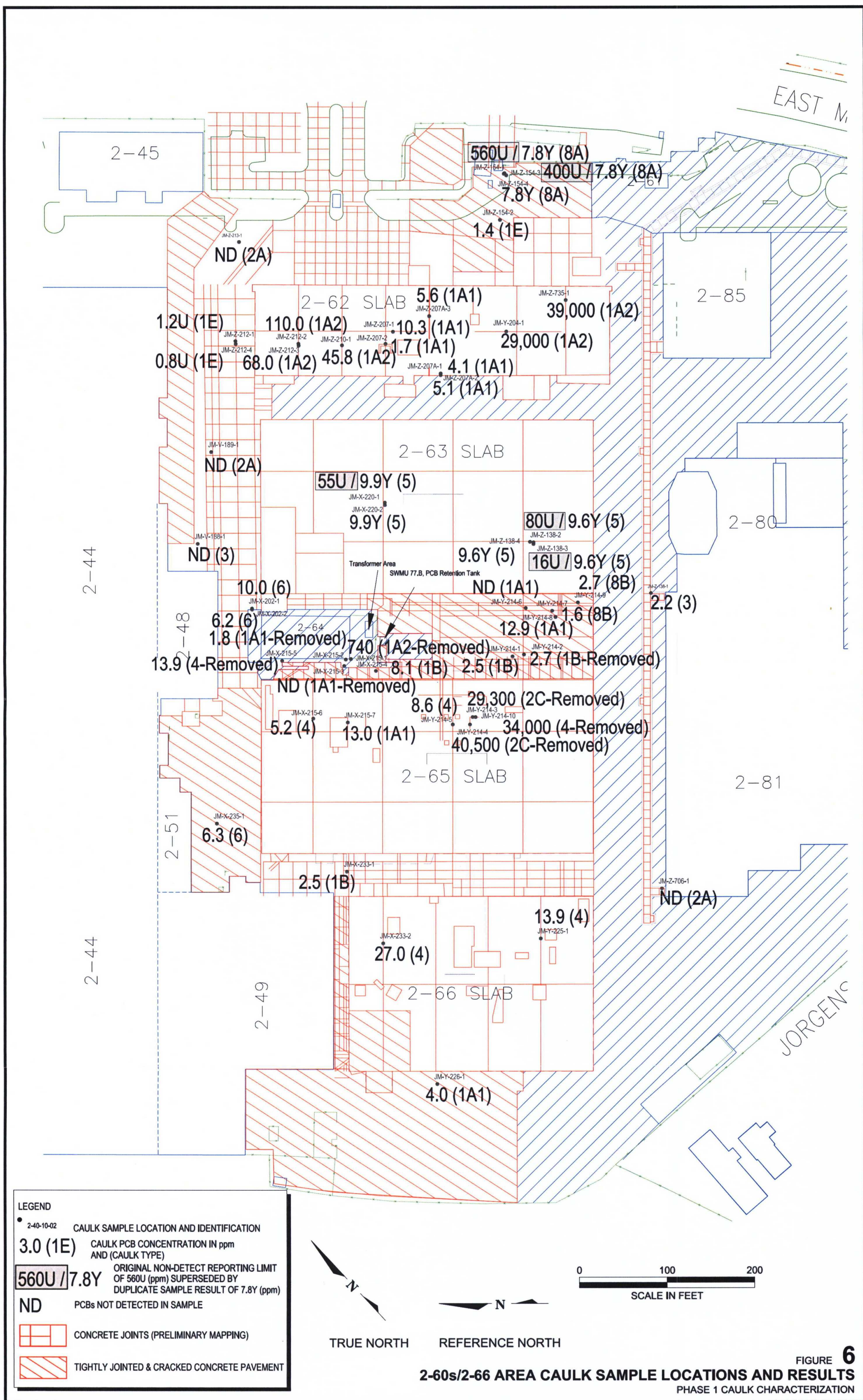


FIGURE 5  
2-40 AREA CAULK SAMPLE LOCATIONS AND RESULTS  
PHASE 1 CAULK CHARACTERIZATION  
Golder Associates











**ATTACHMENT A**

**PHOTOGRAPHS OF CAULK TYPES**







































ATTACHMENT B

DATA VALIDATION QA/QC REVIEW



**BOEING PLANT 2 - INTERIM MEASURE WORK PLAN  
CHARACTERIZATION OF CAULK IN CONCRETE PAVEMENTS  
DATA VALIDATION QA/QC REVIEW**

A total of seventy caulk samples (including duplicates) and four equipment blank samples were collected October 23, 26, 28, 29, 31, and November 27, 2007 as part of an Interim Measure (IM) Work Plan - Characterization of Caulk in Concrete Pavements (Administrative Order 1092-01-22-3008(h)) for the Boeing Plant 2 Facility in Seattle/Tukwila, Washington. The IM Measure Work Plan - Characterization of Caulk in Concrete Pavements (Golder, 2007) sampling effort was performed at the Plant 2 Facility to identify polychlorinated biphenyl (PCB) contaminated caulk. Samples were analyzed by Analytical Resources Incorporated (ARI) of Tukwila, Washington for the following parameter:

- Medium Level Polychlorinated biphenyls (PCBs) by EPA Method 8082

Samples were analyzed in accordance with procedures described in *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (USEPA SW-846, 3rd edition) 8082*.

Samples were analyzed and results reported by the laboratory in batch number as summarized below:

**SDGs LU77& LV40 (Medium Level PCBs):**

**SDG LU77**

PL2IM-2-10-05-01-W	PL2IM-2-10-05-05-C	PL2IM-2-10-32-01-C
PL2IM-2-10-05-02-C	PL2IM-2-10-20-01-C	PL2IM-2-10-32-02-C
PL2IM-2-10-05-03-C	PL2IM-2-10-20-02-C	
PL2IM-2-10-05-04-C	PL2IM-2-10-20-03-C	

**SDG LV40**

PL2IM-2-10-40-01-W	PL2IM-2-10-55-04-C	PL2IM-2-10-60-03-C
PL2IM-2-10-40-02-C	PL2IM-2-10-44-01-C	PL2IM-2-10-65-01-C
PL2IM-2-10-40-03-C	PL2IM-2-10-44-02-C	PL2IM-2-10-65-02-C
PL2IM-2-10-55-01-C	PL2IM-2-10-44-03-C	PL2IM-2-10-65-03-C
PL2IM-2-10-55-02-C	PL2IM-2-10-60-01-C	
PL2IM-2-10-55-03-C	PL2IM-2-10-60-02-C	

**SDG LV52 (Medium Level PCBs):**

PL2IM-2-40-18-01-C	PL2IM-2-10-75-01-C	PL2IM-2-10-75-04-C
PL2IM-2-40-18-02-C	PL2IM-2-10-75-02-C	PL2IM-2-10-80-01-C
PL2IM-2-10-20-04-C	PL2IM-2-10-75-03-C	PL2IM-2-10-80-02-C

**SDG LV55 (Medium Level PCBs):**

PL2IM-2-40-24-02-C	PL2IM-2-40-10-01-C	PL2IM-2-40-06-01-C
PL2IM-2-40-24-03-C	PL2IM-2-40-10-04-C	PL2IM-2-40-06-03-C
PL2IM-2-40-24-04-C	PL2IM-2-40-09-01-C	PL2IM-2-40-01-02-C
PL2IM-2-40-19-02-C	PL2IM-2-40-09-02-C	PL2IM-2-40-01-04-C
PL2IM-2-40-16-01-C	PL2IM-2-40-09-04-C	
PL2IM-2-40-15-02-C	PL2IM-2-40-09-05-C	



**SDGs LV64 & LV98 (Medium Level PCBs):**

PL2IM-2-40-24-01-W	PL2IM-2-40-10-02-C	PL2IM-2-40-06-02-C
PL2IM-2-40-19-01-W	PL2IM-2-40-10-03-C	PL2IM-2-40-01-01-C
PL2IM-2-40-19-03-C	PL2IM-2-40-09-03-C	PL2IM-2-40-01-03-C
PL2IM-2-40-16-02-C	PL2IM-2-40-08-01-C	PL2IM-2-40-01-05-C
PL2IM-2-40-15-01-C	PL2IM-2-40-08-02-C	PL2IM-2-40-19-03A-C
		(SDG LV98)
PL2IM-2-40-15-03-C	PL2IM-2-40-08-03-C	

**SDG LZ46 (Medium Level PCBs):**

PL2-JM-Z-138-4	PL2-JM-Z-154-4	PL2IM-2-10-20-01A-C
PL2-JM-X-220-2	PL2IM-2-40-19-02A-C	
PL2-JM-Z-212-4	PL2IM-2-10-60-02A-C	

**SDG MD73 (RE-Extracted and RE-Analyzed Medium Level PCBs):**

PL2IM-2-10-20-03-C (LU77)	PL2-JM-Z-138-4 (LZ46A)
PL2IM-2-10-20-04-C (LV52)	PL2-JM-X-220-2 (LZ46B)
PL2IM-2-40-01-05-C (LV64)	PL2-JM-Z-154-4 (LZ46D)

Quality assurance/quality control (QA/QC) reviews of laboratory data were performed in the laboratory in accordance with the laboratory quality assurance program plan. The data validation QA/QC review focused primarily on laboratory result summary sheets and quality control summary sheets to ensure that work plan data quality objectives were met for the project. Data validation was conducted in accordance with the criteria outlined in the National Functional Guidelines for Organic Data Review (EPA 1999) and the National Functional Guidelines for Inorganic Data Review (EPA 1994), modified to include method specific requirements of the laboratory analytical methods. Raw data sheets were reviewed as necessary to confirm conditions reported and to support application of qualifiers to analytical results.

The validation level for the data is Level I with a Level II if data were defective, as specified in Section 4.5 in the IM Measure Work Plan – Characterization of Caulk in Concrete Pavements (Golder, 2007) herein referred to as the IM Work Plan (Golder, 2007). It should be noted that Section 4.5 - Data Review, Validation, and Verification of the IM Work Plan (Golder, 2007) indicates that data will undergo a Level 1 (basic) review. A more thorough review (Level II) consistent with criteria specified in Tables 2, 3, and 4 were used to evaluate data quality indicators was performed, with the exception of SDG MD73, due to the complexity of the sample matrix and subsequent analytical issues. A Level I review was performed on SDG MD73 due to quick turnaround requirements. The following is a summary of quality control elements associated with each analytical fraction and the status of that element as a result of the data validation process.

**SAMPLING, DOCUMENTATION AND REPORTING**

In several cases cooler temperatures exceeded the recommended temperature ( $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ) for sample preservation. No action was taken since in these samples were collected and delivered to the laboratory on the same day.



Caulk reporting limits, in some cases, are slightly less than reporting limits for their respective method blanks. ARI indicates that in some cases initial sample volume was slightly greater than method blank which impacts the reporting level. No action was taken as these reporting discrepancies are minor.

- All SDGs: ARI case narrative, extraction, and GC analyst notes indicate that in general caulk sample matrices extraction and analyses for Medium Level PCBs by EPA Method 8082 were problematic. Selected samples were re-extracted and most samples were reanalyzed due to matrix issues and subsequent poor internal standard recoveries, and poor (both low and high) continuing calibration recoveries. Extraction and GC analyst notes indicate that some samples needed both extensive cleanups and/or modified extraction methods due to matrix interference. Poor internal standard recoveries were also reported on continuing calibration and quality control data associated with the sample data.
- SDGs LU77, LV40, LV52, LV64, and LV98: Insufficient volumes were collected for matrix spike analyses. Refer to Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) results for more information.
- Sufficient sample was collected to perform matrix spike analyses on four samples associated with SDG LZ46.
- SDGs LV40, LU77, and LZ46: Field duplicate samples (PL2IM-2-10-20-01A-C, PL2IM-2-10-60-02A-C, and PL2IM-2-40-19-02A-C) were collected November 27, 2007, about one month, after original samples were collected. The locations were identified with paint marks used to identify and label the original locations in late October 2007 (Golder, 2008). Additionally Samples PL2-JM-Z-138-4, PL2-JM-Z-154-4, PL2-JM-Z-212-4, and PL2-JM-X-220-2 were also collected on November 27, 2007. These were duplicates of samples originally obtained during 2005/2006. The locations of these four samples were also based upon paint marks that had been used to label the locations in 2005/2006 (Golder, 2008). Field duplicate data associated with SDGs LV40, LU77, and LZ46 are generally comparable. Refer to Field Duplicate section for more information. No action was taken other than to note this.
- SDG LV55: Sample PL2IM-2-40-06-03-C Aroclor 1260 result was reported as non-detect at the reporting level (790 µg/Kg) however primary column results show that Aroclor was detected at 1,000 µg/Kg while confirmatory column results are reported as non-detect. *The result was hand corrected by the data validator.* PCB results, including Aroclor 1260, for Sample PL2IM-2-40-06-03-C are qualified as estimated (J) due to poor calibration and internal standard recoveries.
- SDG LV64: Cooler Receipt Form shows that label for Sample PL2IM-2-40-19-03-C reads PL2IM-2-40-19-02-C. The label was corrected to be consistent with the Chain of Custody and read PL2IM-2-40-19-03-C.
- SDG LV64: Cooler Receipt Form shows that label for Sample PL2IM-2-40-19-01-W reads PL2-2-40-19-01-W. The label was corrected to read PL2IM-2-40-19-01-W.
- SDG LV64: Sample PL2IM-2-40-08-02-C Aroclor 1260 result was reported as non-detect at the reporting level (790 µg/Kg) however primary column results show that



Aroclor was detected at 820 µg/Kg while confirmatory column results are reported as non-detect. *The result was hand corrected by the data validator.* PCB results, including Aroclor 1260, for Sample PL2IM-2-40-08-02-C are qualified as estimated (J) due to poor calibration and internal standard recoveries.

- SDG LZ46: Sample PL2-JM-X-220-2 may appear as Sample PL2-JM-K-220-2 on the Chain of Custody. Golder contacted ARI to confirm that the correct sample identification is Sample PL2-JM-X-220-2. Sample identification appears to be correct on Form 1 data, was hand corrected by the data validator on the hard copy summary data package and appears to have been hand corrected in the electronic version.
- SDGs LV40, LV52, LV64, LU77, and MD73: In several cases the laboratory assigned a “Y” qualifier to indicate that “the analyte was not detected at or above the reported concentration”. The reporting limit is raised due to chromatographic interference. The Y flag is equivalent to the U flag with a raised reporting limit”.
- SDG MD73: Six samples were selected for re-extraction and re-analysis due to problematic caulk matrices, extraction and analytical issues, and subsequent elevated reporting levels in the original sample results (Refer to SDGs LU77, LV52, and LZ46). Samples were subjected to an extensive three step cleanup process (Solid Phase Extraction (SPE), acid, and silica cleanup). Case narrative notes indicate that the 1:1 methylene chloride/hexane extract was not exchanged to hexane (e.g. viscous-like extract) and as a result Internal Standard # 1 (1-Bromo-2-Nitrobenzene) acts as an interferent on the primary column (Column ZB5). Early eluting surrogate (Tetrachlorometaxylene) and “early range” PCBs (Aroclors 1016, 1221, 1232, 1242, 1248, and 1254) were not reported from this column. Late eluting Internal Standard #2 (Hexabromobiphenyl) from the primary column (Column ZB5) were reported. It should be noted that in all cases the higher on-column concentration of the two surrogates (Decachlorobiphenyl) were reported – per standard procedure. All results associated with SDG MD73 are considered highly estimated (J/UJ) due to the multitude of analytical issues described above. To address the analytical issues caused by caulk matrices recommendations for future analyses might be considered - as follows:
  - Review alternate analytical methods for PCB characterization;
  - Raise the current PCB reporting level to accommodate modified current analytical method;
  - Extract a smaller sample volume to minimize matrix interference;
  - Provide caulk characterization information to analytical laboratory to assist in categorizing samples thus optimizing extraction and analytical methods;
  - Review analytical assessment criteria for caulk characterized as “soft, spongy, and pliable” (e.g. Caulk Types 2A, 5, and 8A) as it appears that these samples were most problematic for the laboratory.

## POLYCHLORINATED BIPHENYLS

The laboratory provided a full data package for the PCB analysis (with the exception of SDG MD73); the items reviewed during validation are summarized below.



### **Analytical Methods – acceptable**

Samples for PCB analysis were analyzed by gas chromatography/mass spectrometry (GC/MS) using EPA SW846 Method 8082. Extraction methodology was modified in some cases (e.g. reduced initial sample volume extracted, use of sonication to break apart recalcitrant samples, increased volume of solvent exchange during cleanup step, multiple cleanup steps) to improve efficacy of extraction. Required reporting limits were met in most cases.

### **Sample Holding Times– acceptable**

All samples were extracted within 14 days of collection and analyzed within 40 days of sample extraction with the following exceptions:

- SDG LV55: All samples were extracted one day beyond the EPA recommended fourteen day holding time as stipulated in Table 2 of the Sampling Analysis Plan. The EPA holding time criteria are applicable to soil samples not caulk samples, no action was taken solely on this basis.
- SDG LV64: All samples were extracted one and two days beyond the EPA recommended fourteen day holding time as stipulated in Table 2 of the Sampling Analysis Plan. The EPA holding time criteria are applicable to soil samples not caulk samples, no action was taken solely on this basis.
- SDG MD73: All samples were extracted between twenty and fifty-six days beyond the EPA recommended fourteen day holding time as stipulated in Table 2 of the Sampling Analysis Plan. The EPA holding time criteria are applicable to soil samples not caulk samples, no action was taken solely on this basis.

### **Laboratory Reporting Limits – acceptable**

The laboratory achieved the reporting limits (RLs) required per the IM Work Plan (Golder, 2007).

The reporting limits were not met in cases in which the samples were analyzed at dilutions due to high concentrations of target compounds or matrix interference with the following discussion:

- SDG LV64: Review of chromatograms, extraction, and GC analyst notes associated with Samples PL2IM-2-40-01-01-C, PL2IM-2-40-01-03-C, and PL2IM-2-40-01-05-C show that there are some heavy ended interferences particularly in sample PL2IM-2-40-01-05-C. The samples were re-extracted with a reduced initial sample volume and increased solvent exchange volume during the cleanup step. In two of three cases (Samples PL2IM-2-40-01-03-C, and PL2IM-2-40-01-05-C) a review of caulk type indicates that these samples were characterized in the field as soft, pliable and spongy. Sample results for PL2IM-2-40-01-01-C, PL2IM-2-40-01-03-C, and PL2IM-2-40-01-05-C are qualified as estimated (UJ/J) due to heavy ended matrix interference. Refer to SDG MD73 for more information about re-extracted and re-analyzed Sample PL2IM-2-40-01-05-C.
- SDG LZ46: Review of chromatograms, extraction, and GC analyst notes associated with Samples PL2-JM-Z-138-4, PL2-JM-X-220-2, and PL2-JM-Z-212-4 shows that there are some heavy ended interferences and that samples were initially analyzed at a 50X dilution with no useable data. Samples PL2-JM-X-220-2, and PL2-JM-Z-212-4 were re-



extracted using sonication (rather than vortex) and diluted 500 times prior to analysis. Extraction notes indicate that these samples absorbed the solvent extract. Sample PL2-JM-Z-138-4 was centrifuged, brown sticky material was removed during the solvent exchange process, and the extract was diluted 500 times prior to analysis. In all three cases review of caulk type indicates that these samples were characterized in the field as soft, pliable and spongy. Sample results for PL2-JM-Z-138-4, PL2-JM-X-220-2, and PL2-JM-Z-212-4 are qualified as estimated (UJ/J) due to heavy ended matrix interference. Refer to SDG MD73 for more information about re-extracted and re-analyzed Samples PL2-JM-Z-138-4, PL2-JM-X-220-2, and PL2-JM-Z-212-4.

- SDG MD73: A Level I data review was performed on six samples which were selected for re-extraction and re-analysis due to inherently difficult caulk matrices, extraction and analytical issues, and subsequent elevated reporting levels in the original sample results (Refer to SDGs LU77, LV52, and LZ46). In all cases reporting limits were similar to or lower than original analyses results. Due to the multitude of analytical issues mentioned under the Sampling Documentation and Reporting Section all results associated with SDG MD73 are considered highly estimated (J/UJ) due to poor data quality.

### Instrument Calibration

A review of the instrument calibration, and calibration frequency was performed. All of the initial calibration criteria for the target analytes, as listed on Table 4 of the IM Work Plan, were met however due to analytical issues with the caulk sample matrix many continuing calibration (CCAL) criteria were not met and impacted samples are listed as follows:

Sample	Compound	Qualification	Reason
LV52 PL2IM-2-40-18-01-C PL2IM-2-40-18-02-C PL2IM-2-10-20-04-C PL2IM-2-10-75-01-C PL2IM-2-10-75-02-C PL2IM-2-10-75-03-C PL2IM-2-10-75-04-C PL2IM-2-10-80-01-C PL2IM-2-10-80-02-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	CCAL 11/20-21/07 >15% D
LV55 All Samples	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	CCAL 11/20-21/07 >15% D
LV40 PL2IM-2-10-40-02-C PL2IM-2-10-40-03-C PL2IM-2-10-55-01-C PL2IM-2-10-55-02-C PL2IM-2-10-55-03-C PL2IM-2-10-55-04-C PL2IM-2-10-44-01-C PL2IM-2-10-44-02-C PL2IM-2-10-44-03-C PL2IM-2-10-60-01-C PL2IM-2-10-60-02-C PL2IM-2-10-60-03-C PL2IM-2-10-65-01-C PL2IM-2-10-65-02-C PL2IM-2-10-65-03-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	CCAL 11/20/07 >15% D



Sample	Compound	Qualification	Reason
LU77 PL2IM-2-10-05-02-C PL2IM-2-10-05-03-C PL2IM-2-10-05-04-C PL2IM-2-10-05-05-C PL2IM-2-10-20-01-C PL2IM-2-10-20-02-C PL2IM-2-10-20-03-C PL2IM-2-10-32-01-C PL2IM-2-10-32-02-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	CCAL 11/06/07 >15% D
LV64 PL2IM-2-40-19-03-C PL2IM-2-40-16-02-C PL2IM-2-40-15-01-C PL2IM-2-40-15-03-C PL2IM-2-40-10-02-C PL2IM-2-40-10-03-C PL2IM-2-40-09-03-C PL2IM-2-40-08-01-C PL2IM-2-40-08-02-C PL2IM-2-40-08-03-C PL2IM-2-40-06-02-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	CCAL 11/21/07 >15% D
LV98 PL2IM-2-40-19-03A-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	CCAL 11/21/07 >15% D
LZ46 PL2-JM-Z-212-4 PL2IM-2-40-19-02A-C PL2IM-2-10-60-02A-C PL2IM-2-10-20-01A-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	CCAL 12/04-05/07 >15% D

- SDGs LV40, LV52, LV55, LV64, and LV98: Analyst notes indicate that the initial calibration data file for Aroclor 3268 was corrupted and as a result the standard was reanalyzed several hours later. No action was necessary as initial calibration criteria were met and there is no impact to the samples.
- SDGs LV40, LV52, LV55, LV64, LV98, LU77, and LZ46: On November 6, 20 and 21, December 4 and 5, 2007 opening and closing continuing calibration data for Aroclors 1260 were generally recovered “high” (calculated amount was greater than the true amount) thus percent differences exceeded 15%. Typically closing CCAL data for Aroclors 1016, 1248, and 1254 were recovered low (calculated amount was less than the true amount). In these cases all associated sample data are qualified as estimated (UJ/J). Refer to Internal Standards for additional information.

#### Blank Contamination – acceptable

The method and equipment blanks (Samples PL2IM-2-40-24-01-W, PL2IM-2-40-19-01-W, PL2IM-2-10-05-01-W, and PL2IM-2-10-40-01-W) were free of target compounds.

#### Surrogate Recovery

All surrogate recoveries were within control limits with the following exceptions:

- SDG LV52: Decachlorobiphenyl (DCBP) surrogate recovery for Sample PL2IM-2-10-20-04-C was high and above criteria stipulated in the IM Work Plan (also above ARI



control limit criteria). Review of sample data indicates that the reporting limit was elevated due to various interferences. No action was taken on the basis of elevated surrogate recovery however Sample PL2IM-2-10-20-04-C results are qualified (UJ/J) due to poor continuing calibration data. Refer to Calibration Section for more details.

- SDG LV64: DCBP surrogate recovery for Sample PL2IM-2-40-01-05-C was not recovered and reported by ARI as 'NR'. Review of associated chromatogram and extraction and GC analyst notes show that there are some heavy ended interferences in this sample which likely interfered with the late eluting DCBP surrogate. Aroclors 1242 and 1260 are 'Y' qualified due to interferences. Extraction notes indicate that during the first extraction the sample absorbed the solvent extract. ARI adjusted the extraction method accordingly with a smaller volume of sample and a larger volume of solvent used during the cleanup stage. Analyst notes indicate that while no PCBs were detected the sample it could not be rerun at a more concentrated extract due to the noted interferences. Sample results for PL2IM-2-40-01-05-C are qualified as estimated (UJ/J) due to heavy ended matrix interference.
- SDG LV40: DCBP surrogate recovery for Sample PL2IM-2-10-65-03-C was high and slightly above criteria stipulated in the IM Work Plan (but within ARI control limit criteria). No action was taken on the basis of elevated surrogate recovery however Sample PL2IM-2-10-65-03-C results are qualified (UJ/J) due to poor continuing calibration data. Refer to Calibration Section for more details.
- SDG LU77: DCBP surrogate recovery for Sample PL2IM-2-10-05-05-C was high and slightly above criteria stipulated in the IM Work Plan (but within ARI control limit criteria). No action was taken on the basis of elevated surrogate recovery however Sample PL2IM-2-10-05-05-C results are qualified (UJ/J) due to poor continuing calibration data. Refer to Calibration Section for more details.
- SDG LZ46: DCBP and tetrachlorometaxylene (TCMX) surrogates were not recovered due to a necessary 500X dilution on Samples PL2-JM-Z-138-4, PL2-JM-X-220-2, and PL2-JM-Z-212-4. No action was taken on this basis. Refer to Calibration Section for more details.
- SDG MD73: No TCMX surrogates were reported from the primary column (Column ZB5) due to Internal Standard #1 interference. All data associated with SDG MD73 is qualified as estimated (UJ/J) due to poor data quality.

#### Internal Standard Recovery

The internal standard criteria were met with the following exceptions:

Sample	Compound	Qualification	Reason
LV52 PL2IM-2-40-18-01-C PL2IM-2-40-18-02-C PL2IM-2-10-75-01-C PL2IM-2-10-75-02-C PL2IM-2-10-75-03-C PL2IM-2-10-75-04-C PL2IM-2-10-80-01-C PL2IM-2-10-80-02-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	Hexabromobiphenyl (Internal Standard # 2) % Recovery < Lower Area Limit of 50% though >10%



Sample	Compound	Qualification	Reason
LV55 All Samples	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	Internal Standard # 2 % Recovery < Lower Area Limit of 50% though >10%
LV40 PL2IM-2-10-55-04-C PL2IM-2-10-44-02-C PL2IM-2-10-44-03-C PL2IM-2-10-65-01-C PL2IM-2-10-65-02-C PL2IM-2-10-65-03-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	Internal Standard # 2 % Recovery < Lower Area Limit of 50% though >10%
LU77 PL2IM-2-10-05-03-C DIL	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	Internal Standard # 2 % Recovery < Lower Area Limit of 50% though >10%
LV64 PL2IM-2-40-19-03-C PL2IM-2-40-16-02-C PL2IM-2-40-15-01-C PL2IM-2-40-15-03-C PL2IM-2-40-10-02-C PL2IM-2-40-10-03-C PL2IM-2-40-09-03-C PL2IM-2-40-08-01-C PL2IM-2-40-08-02-C PL2IM-2-40-08-03-C PL2IM-2-40-06-02-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	Internal Standard # 2 % Recovery < Lower Area Limit of 50% though >10%
LV98 PL2IM-2-40-19-03A-C	Aroclors 1016, 1242, 1248, 1254, 1260, 1221, 1232	UJ/J	Internal Standard # 2 % Recovery < Lower Area Limit of 50% though >10%

It should be noted that recoveries for hexabromobiphenyl (Internal Standard # 2) on the primary and/or the confirmatory GC Columns (Columns ZB5 and ZB35) were below ARI's lower limit for nearly all samples, most associated QC, and most opening and closing calibrations due to matrix interference with one exception. Refer to the Calibration Section for additional information.

- SDG LV64: Percent recoveries for 1-Bromo-2-Nitrobenzene (Internal Standard #1) were above the upper control limit for QC associated with water samples. No action was taken since internal standards for the two water samples were within control limit criteria.
- SDG MD73: Case narrative notes indicate that extracts were not exchanged to hexane and as a result Internal Standard #1 interferes with surrogate and PCB results. Internal Standard # 2 was out of control "high" (above upper control limit) on Sample PL2-JM-X-220-2 due to matrix effects. All data associated with SDG MD73 is qualified as estimated (UJ/J) due to poor data quality.

#### Matrix Spike Compound Recovery

Matrix Spike/Matrix Spike Duplicate (MS/MSD) spike recoveries and relative percent difference (RPD) were acceptable per IM Work Plan (Golder, 2006) with the following discussions:



- SDGs LV40, LV52, LV64, LV98, LU77, and MD73: Matrix spike analysis was not performed. Refer to LCS/LCSD results for more information.
- SDG LV55: MS/MSD was performed on sample PL2IM-2-40-16-01C. Spiking compound Aroclor 1260 percent recoveries were elevated (158% and 168%) and exceed WP specified criteria of 40 %-140 % Table 4 of the IM Work Plan. No action is taken solely on this basis. Refer to Calibration and Internal Standard Recovery Sections for more information on this sample.
- SDG LZ46: Four sets of MS/MSDs were performed on four samples associated with SDG LZ46. Percent recoveries and RPDs are considered acceptable and within IM Work Plan criteria.

#### Laboratory Control Sample Recovery

Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD) spike recoveries and RPD were acceptable per IM Work Plan (Golder, 2006) with the following discussion:

- SDG LV52, LV55, LV64, and LV98: Spiking compound Aroclor 1260 percent recoveries were slightly elevated and exceed WP specified criteria of 40 %-140 % Table 4 of the IM Work Plan. No action is taken solely on this basis. Refer to Calibration and Internal Standard Recovery Sections for more information on associated samples.
- SDG MD73: No LCSD was performed however precision data were available through re-extracted and re-analyzed field duplicate pair - Samples PL2IM-2-10-20-04-C and PL2IM-2-10-20-03-C.

#### Field Duplicate Sample Analysis

Field duplicate samples were collected and analyzed as follows:

Laboratory SDG	Sample	Field Duplicate
LV52	PL2IM-2-10-75-01-C	PL2IM-2-10-75-02-C
LV52/LU77	PL2IM-2-10-20-04-C	PL2IM-2-10-20-03-C
MD73	RE-PL2IM-2-10-20-04-C	RE-PL2IM-2-10-20-03-C
LV55	PL2IM-2-40-24-03-C	PL2IM-2-40-24-04-C
LV55/LZ46	PL2IM-2-40-19-02-C	PL2IM-2-40-19-02A-C
LV55	PL2IM-2-40-09-04-C	PL2IM-2-40-09-05-C
LV64	PL2IM-2-40-08-02-C	PL2IM-2-40-08-03-C
LU77/LZ46	PL2IM-2-10-20-01-C	PL2IM-2-10-20-01A-C

Field duplicate data are considered comparable with the following discussion:

- SDGs LV52/LU77: No target analytes were detected in field duplicate pair however reporting levels are raised two fold (with a raised reporting limit for Aroclor 1260) for Sample PL2IM-2-10-20-03-C and three fold (with a raised reporting limit for Aroclor 1260) for Sample PL2IM-2-10-20-04-C. No action was taken solely on this basis.



- SDGs LU77/LZ46: PCB Aroclor 1260 in sample and sample duplicate (PL2IM-2-10-20-01-C and PL2IM-2-10-20-01A-C) results were 2,300 and 3,500 ug/Kg, respectively. No action was taken on this basis other than to note this as a disagreement.

## DATA QUALIFIERS

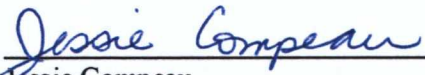
Data qualifiers applied by the laboratory have been removed from the data summary report sheets and superseded by data validation qualifiers as follows:

The following qualifiers were used to modify the data quality and usefulness of individual analytical results.


- U - The constituent was analyzed for, but was not detected above the reported sample quantitation limit.
- J - The constituent was positively identified and detected; however, the concentration reported is an estimated value because the result is less than the quantitation limit or quality control criteria were not met.
- UJ - The constituent was not detected; the associated quantitation limit is an estimated value because quality control criteria were not met.
- R - Data are rejected due to significant exceedence of quality control criteria. The analyte may or may not be present. Additional sampling and analysis may be required to determine the presence or absence of the constituent. For statistical reasons, rejected values are not included in the database.
- Y - The reporting limit is elevated due to interference. The result is not detected.

## DATA ASSESSMENT

Data review and validation was performed by an experienced quality assurance chemist independent of the analytical laboratory and not directly involved in the project. This is to certify that I have examined the analytical data and based on the information provided to me by the laboratory, in my professional judgment, the data are acceptable for use except where indicated by data qualifiers, which may modify the usefulness of those individual values.

  
\_\_\_\_\_  
Jessie Compeau  
Validator  
Informa, LLC

January 9, 2008  
Date

  
\_\_\_\_\_  
Kent M. Angelos  
Project Director  
Principal Environmental Scientist

January 21, 2008  
Date



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Phase 1 Report and Work Plan  
Characterization of Caulk in Concrete Pavements at Boeing Plant 2

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CDs 2 to 15 E  
1. Phase I & Work Plan  
2. Appendices A-F

APPENDICES A – F

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